Alberta Forest Management Planning Standard

Alberta Sustainable Resource Development
Public Lands and Forests Division
Forest Management Branch
Version 4.1 - April 2006

Alberta Forest Management Planning Standard

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Alberta Forest Management Planning Standard

Section 1
Interpretation of CAN/CSA-Z809-2002

Section 2
FMP Process and Content

Alberta Sustainable Resource Development
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Preamble

The Alberta Forest Management Planning Standard[1] (the standard) and its annexes, *interpretive bulletins* and updates comprise the standard for preparing and implementing Forest Management Plans (FMP) in Alberta. This standard replaces all previous forest management planning manuals published by the Government of Alberta *(Alberta)* unless otherwise directed in a *Forest Management Agreement (FMA)*.

The implementation date of the standard is May 1, 2006.

Alberta has adopted the CAN/CSA-Z809-2002 *Sustainable Forest Management: Requirements and Guidance Document* (referred to as CSA Z809-02) as the forest management planning system. All standards in CSA Z809-02 apply to forest management planning in Alberta except where specifically excluded in the Alberta standard. Certification is recommended but not mandatory in Alberta, and CSA Z809-02 is designed to enable certification by third party auditors.

Review and Update Process

The contents of the Alberta standard will be reviewed when CSA Z809-02 is reviewed or earlier if deemed necessary by Alberta. To this end, interested parties will be invited to participate in a periodic review designed to recommend clarification or improvements to the Standard. The review will be conducted according to the public participation requirements of CSA Z809-02.

The Alberta Planning Process

The forest management process used in Alberta is detailed in the standard. In addition to being based on the requirements of CSA Z809-02[2], the standard provides additional interpretation and details necessary to meet the needs of Alberta. All FMPs prepared by industry in Alberta shall follow the process described in this standard.

Although the standard is based on CSA Z809-02, neither this nor any other certification method is specifically endorsed by Alberta. All credible certification methods necessitate that operations meet the legal requirements set out in the standard. FMPs prepared according to the standard will be in a good position to receive certification under any scheme; however, certification is not required for FMP *approval* by Alberta.

Alberta relies on the competence and professionalism of regulated forestry professionals (RFP) to apply sound forestry principles and practices.

The standard's focus is to ensure a strong and direct connection between,

- the *desired future forest* condition and a spatially planned harvest sequence, and
- predictions of forest growth and yield and actual stand level performance.

Alberta shall consult with each FMA holder to explain how the standard applies to existing and future FMPs. A transition process will be established following these discussions and points of agreement shall be documented in the *Terms of Reference (ToR)* for the FMP.

Alberta's objective is to select a *sustainable forest management* scenario that will require minimal changes until the next management plan is approved.

Organization of the Standard

A copy of CAN/CSA Z809-02 is required for using the standard[1]. The term *Alberta* is used throughout the standard, in lieu of specific department, branch or section names to avoid the need to modify the standard when name changes occur within the provincial government. Specific departments, branches, sections or positions with approval authorities are

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[1] The Forest Management Planning Standard (the Standard) is the forest management planning manual referenced in Forest Management Agreements (FMA), other timber tenure documents, and government policies.

[2] CAN/CSA-Z809-02 – available at no cost in .pdf format at http://www.csa-international.org at the onlinestore.

published in *interpretive bulletins*. The term "Organization" is used generically to refer to the operator preparing a FMP. Words and terms defined in Appendix B of Section 2 appear in *italics* throughout the text.

Forest Management Documents

- *Alberta Forest Management Planning Standard (Sections 1&2) – Interprets CSA Z809-02 and will be reviewed when CSA Z809-02 is reviewed and updated, as necessary.*
- *Annexes and Appendices – specific standards and information necessary to clarify standard. Will be reviewed as necessary by Alberta in consultation with stakeholders.*
- *Directives – (not part of standard) provide specific detail and standards, on a variety of forest management issues.*
- *Interpretive Bulletins – discussion, information and direction on current forest management practices.*

A listing of the individual standards constitutes a checklist. Adherence to this list shall be used to demonstrate a RFP's *due diligence* and accuracy of the submission.

The Forest Management Planning Standard is comprised of the following:

- **Section 1 - Interpretation of CSA Z809-02** – contains guidance on which standards in CSA Z809-02 apply to Alberta FMPs and provides additional information on how Alberta will interpret applicable CSA Z809-02 standards.
- **Section 2 - Forest Management Plan Content and Process** – states the FMP process and the content requirements in Alberta.
- **Annexes** - a series of documents which will be updated periodically, that state technical and process standards.
- **Interpretive Bulletins** - a series of documents published periodically providing clarification as required.

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Section 1 - Interpretation of CSA Z809-02 Standards

The following discussion uses the headings and numbering specific to CSA Z809-02. Standards applicable to Alberta are clarified, and those not applicable are noted. The comments explain Alberta's requirements or describe how Alberta interprets the standard.

Note: If a standard is not mentioned, it applies as written without interpretation or change.

CSA - 0.1 General

Forest certification is not mandatory in Alberta.

CSA - 0.2 High Standard of Public Involvement

The public involvement process shall describe how decisions will be made. Alberta has sole decision-making authority and will strive to ensure that *issues* raised in the public involvement process are addressed. Alberta's objective is for stakeholders and participants in the forest management process to reach a high degree of agreement. Alberta shall arbitrate disagreements where, in Alberta's opinion, agreement is not feasible.

CSA - 0.4 A Performance Standard

Annex 4 contains the minimum performance standards required for an acceptable FMP in Alberta.

CSA - 0.8 Third-Party Independent Audits

Third-party audits are not compulsory.

CSA - 1.0 Scope

A FMP must meet the requirements of applicable CSA Z809-02 clauses as described in the standard.

CSA - 3.0 Definitions and Abbreviations

In addition to those in CSA Z809-02, the definitions pertinent in Alberta are contained in this standard. Where CSA and Alberta define the same term in different ways, Alberta definitions prevail. Words and terms defined in Appendix B of Section 2 appear in *italics* throughout the text.

CSA - 4.0 Sustainable Forest Management

FMPs prepared by industry in Alberta have limited scope owing to the rights granted in FMAs which are the rights to establish, grow and harvest and remove timber subject to FMP approval by Alberta. FMA holders are specifically prohibited from restricting access or constraining Alberta's right to manage other resources or allocate lands for other industrial uses. FMPs shall focus on how activities (i.e., establishing, growing and harvesting timber) of FMA holders and other timber operators on an FMA will be managed in order to reduce the negative impacts on other resource users and resource values. This will be accomplished by managing the forest management activities so as to create a desirable future forest.

From time to time, Alberta prepares strategic land use plans (e.g., Integrated Resource Plans, Regional Sustainable Development Strategies) that address the integration of resource uses. Existing strategic land use plans take precedence over FMPs and provide strategic direction that shall be honoured in the FMPs. The direction may be through zoning, which limits activities in various zones, or by setting values, objectives, indicators or targets to be implemented.

Where strategic land use plans are approved after a FMP has been approved, Alberta and the Organization shall discuss implementation of the strategic land use plan and Alberta may require the FMP to be amended.

CSA - 4.2 (c) Not all parts of standard 7 are required (see discussion in CSA section 2).

CSA - 5.0 Public Participation Requirements

Organizations must have Alberta's approval for a public participation program that addresses the standards in CSA – 5.0. If participants notify Alberta that they cannot agree to the Basic Operating Rules (BOR), Alberta shall arbitrate.

Area-based tenure (FMA) holders are responsible for preparing FMPs and must demonstrate to Alberta that volume-based tenure holders affected by the FMP have been provided with meaningful opportunities for

participation in the planning process. Although the Organization must bear the cost of the FMP, volume-based tenure holders are encouraged to reach agreement with the FMA holder to share the direct costs of the planning process (e.g., data sharing, company-specific TSA analysis).

CSA - 5.2 c, d, e Interested Parties - Aboriginal Forest Users and Communities.

Alberta's consultation policy for first nations on land management and resource development applies. Organizations will provide opportunities for *meaningful consultation* to aboriginal forest users and communities concerning forest management on the DFA.

Meaningful consultation requires consulting in good faith, with honest communication and an open exchange of relevant information before decisions are made. The mechanisms for this shall be outlined in the *Terms of Reference* for the *forest management plan.*

CSA - 6.0 SFM Performance Requirements

The mandatory values, objectives, indicators and targets (VOITs), identified by Alberta in Annex 4 shall be addressed in FMPs.

CCFM Criterion 1 – Conservation of Biological Diversity

Quantitative targets shall be developed by the Organization in consultation with stakeholders and rationalized based on social acceptance, sound science, credible analysis techniques, and clearly stated value trade-offs. Alberta has established minimum performance standards for how biodiversity values are addressed in Forest Management Plans. Annex 4 provides the framework for linking biodiversity values to clear objectives and measurable indicators and targets.

CSA Z809-02 defines four Elements under Criterion 1 and these are interpreted as follows:

Element 1.1 - Ecosystem Diversity corresponds to *"coarse filter" management*; i.e., maintaining natural patterns at the landscape scale.

Element 1.2 - Species Diversity corresponds to "fine filter" management; i.e., managing for the needs of individual species.

Element 1.3 - Genetic Diversity focuses on the genetics of tree species. It is assumed that in meeting the intent of Elements 1.1 and 1.2, the *genetic diversity* of other organisms will have been addressed.

Element 1.4 - Protected Areas and Sites of Special Significance

Alberta has the authority to establish protected areas and sites of special significance, which is addressed through other land use planning methods.

Refer to Annex 4 for the requirements for values, objectives indicators and targets for FMPs.

Monitoring Biodiversity

The indicators, targets, and methods outlined in Annex 4 represent pragmatic approaches to conserving forest biodiversity. The Organization is responsible to ensure that operational targets are met.

Biodiversity is potentially affected by a complex array of factors. Consequently, best practices may have limited success in meeting biodiversity objectives, even if they are completely and effectively implemented.

Organizations are encouraged to participate in long-term, scientifically rigorous biodiversity monitoring to assess achievement and effectiveness of objectives. Organizations should find meaningful ways to participate in and support programs such as the Alberta Biodiversity Monitoring Program. Cooperation and/or coordination with other companies and agencies in landscape-scale programs could provide a larger context within which to compare company performance. Biodiversity conservation is to be addressed in the context of *adaptive management*; it is important for biodiversity monitoring to be undertaken to obtain results that can be fed back into the planning process.

CCFM Criterion 2 – Maintenance and Enhancement of Forest Ecosystem Condition and Productivity

The timber supply analysis described in Annex 1 shall define the future forest conditions that will meet this criterion.

CCFM Criterion 4 – Forest Ecosystem Contributions to Global Ecological Cycles

As forest carbon budget models are upgraded and the administrative systems are established, the requirements for addressing carbon *issues* shall be addressed in updates to the standard or *interpretive bulletins*.

CCFM Criterion 5 – Multiple Benefits to Society

Organizations are not obligated to address Element 5.3. Alberta is responsible for allocating resources.

CSA - 7.0 SFM System Requirement: The Continual Improvement Loop

If the FMA holder pursues certification/registration, Alberta shall not be a co-registrant. The defined forest area (DFA) shall be the geographic boundaries of the FMA and associated FMUs as a minimum, but may include adjacent areas if the participants in the process and Alberta believe there is sufficient reason to do so. Volume based tenure holders shall follow the approved FMP and are to be meaningful participants in the forest management process.

Alberta has established the performance standards (VOITs) to be measured and reported (see Annex 4). These VOITs must be addressed in detail in FMPs and others may be added in the process of localizing the FMP.

Forecasting in FMPs shall be based primarily on changes in forest cover with interpretations included regarding how these changes will affect other indicators. Forecasting and monitoring to assess the effectiveness of the forecasted forest cover in attaining the VOITs in the FMP may involve inventorying resources other than forest cover. When inventories of other resources are not specifically required in a FMA, such inventories shall be conducted co-operatively whenever possible.

CSA - 7.1 General

The system requirements are not Alberta's predominant concern. The following discussion limits Alberta's requirements for system information to be included as part of a FMP.

CSA - 7.2 SFM Policy

Since all of the requirements listed in the standard are mandatory, it would be wise for the Organization to provide such a policy statement, however, this is not necessary for a FMP to be approved.

CSA - 7.3 Planning

To create an approvable FMP, it is desirable that all parties be involved that are necessary to address the SFM elements. In some cases, this may not be practical or feasible.

CSA - 7.3.4 Not applicable for a FMP. These matters are either addressed elsewhere in the standard or by other regulatory regimes.

CSA - 7.4 Implementation and Operation

CSA Standards 7.4.1, 7.4.2, 7.4.3.1(a), 7.4.4.1, 7.4.4.2, 7.4.4.3, 7.4.6, 7.4.7 are not required in a FMP.

CSA - 7.5 Checking and Corrective Action

CSA Standards 7.5.1.5, 7.5.1.6, 7.5.2, 7.5.4, 7.6 are not required in a FMP.

CSA - Annex A - Certification (Registration) Framework

Not required for a FMP.

CSA - Annex B – Summary of Requirements of CSA Z809-02

Applicable, subject to the discussion above.

CSA - Annex C - Specific Performance Requirements

See Annex 4.

Section 2 - FMP Process and Content Standards

There are two components:

- *Terms of Reference (ToR)* – describes the process for developing a FMP. CSA Z809-02 standard 5.3.1 provides a comprehensive list of components for the Basic Operating Rules (BOR) to be addressed in the ToR.
- *Forest Management Plan (FMP)* – components as listed in CSA Z809-02 standard 7.3.7.

1.0 Terms of Reference (ToR)

The *Terms of Reference* shall be structured to follow CSA Z809-02 standard 5.3.1 as follows:

1.1 Content

The ToR shall describe the process from the point of starting work on a detailed FMP to starting work on the next FMP. It is to include such matters as the revision of the *Timber Harvest Planning and Operating Ground Rules (OGR)* and submission of Stewardship Reports. In the event of a new FMA, it shall describe the process from starting the preliminary FMP to starting the detailed FMP. The ToR will not address the specific details of the FMPs but rather focus on the process for their development approval and monitoring. The ToR shall be revised periodically as new information becomes available. The ToR must be approved by Alberta.

This section of the ToR must describe the area under consideration, and the basic administrative units that are needed later in the process (see Annex 1, standard 5.0).

1.2 Goals

Create a clear, timely process to efficiently manage the forest management process.

1.3 Timelines

Provide a detailed schedule (e.g., Gantt chart) for the development, approval and monitoring process. The schedule shall address the following matters as a minimum:

i. vegetation inventory (including understorey inventory) preparation, updates and approval
ii. public participation program activities
iii. landbase description and yield projection activities and approval
iv. forecasting and harvest planning activities
v. ground rule process
vi. monitoring program submissions and action plan deadlines

1.4 Internal and External Communication

Describe the means by which the Organization and Alberta will deal with public inquiries and the press. Describe the process by which the Organization will make FMPs, approvals, Annual Reports, Stewardship Reports and FMA OGRs available to the public.

1.4.1 Submission Requirements

Approved FMPs and reports are public documents. In addition to the Organization's methods for making these available to the public, Alberta shall make approved FMPs and reports available to the public by posting them on the departmental website. FMPs, analyses, reports and checklists shall be submitted in a format acceptable to Alberta. The Organization submitting a FMP, analysis, Annual Report or Stewardship Report must submit the following to Alberta:

i. five paper copies of the FMP or report
ii. one single digital copy of technical files
iii. five digital copies (password protected and password supplied, .pdf format)
iv. a RFP validated checklist describing the extent of compliance with applicable standards included with each submission.

1.5 Roles, Responsibilities and Obligations of Participants

Participants shall be organized in two groups:

i. Plan Development Team (PDT) - to comprise staff from the Organization and Alberta. The PDT is to reach *agreement-in-principle* on technical matters in a timely manner and act as advisors to the public. A core membership list shall be published through *interpretive bulletins*.

ii. Public Participation Group (PPG) - to be formed with representation from interested parties. The mechanism for governance of the PPG is variable and depends on the nature of interested stakeholders.

1.6 Conflict of Interest

A mechanism to deal with conflict of interest shall be articulated.

1.7 Decision-making Methods

1.7.1 Progressive Review of Plan Components and Final Approval of the FMP

As plan components are developed and agreement is reached by the Plan Development Team, the PDT shall recommend those components receive *agreement-in-principle*. *Agreement-in-principle* is not final approval, but rather Alberta's notice to the Organization that what has been prepared is acceptable to that point. Final approval of all components shall be granted only when the FMP receives final approval.

Final approval of the FMP shall be through an Approval Decision that presents the rationale for approving the plan, direction from Alberta to the Organization to complete additional post-approval work or modify proposed activities, and the allocation of approved annual allowable cuts (AAC).

Before the FMP is submitted, the Organization shall conduct a meaningful review of the complete FMP with the PPG followed by the PDT. The Organization shall submit the comments from the PPG and PDT and its response to the comments along with the FMP. Following these reviews, Alberta shall convene an Approval Review Committee, made up of senior Alberta staff to consider evaluations of the PPG and PDT, and provide recommendations for consideration and final approval.

The FMP development process may be brought to an end when, Alberta believes further discussions will be of limited value in moving the FMP to completion. When this authority is exercised, the Organization shall be directed to prepare the FMP for review by the PPG and PDT, followed by submission to Alberta for a decision.

1.8 Authority for Decisions

A listing of approval responsibilities of Alberta staff for various components of a FMP shall be published in *interpretive bulletins* from time to time.

1.9 Mechanisms to Adjust the Process

The ToR shall describe the process by which changes and updates will be incorporated.

1.10 Access to Information

The ToR shall define the information that will be made available to various participants.

1.11 Participation of Experts, Other Interests and Government

Approval of FMPs by Alberta does not grant or imply federal government approval. Provincial licences, authorizations and approvals issued under the *Forests Act*, Water Act or Public Lands Act do not mean the Organization (applicant) has complied with federal legislation.

At its discretion, Alberta shall refer FMPs or parts of them, in draft or final version, to independent experts for review.

1.12 Dispute Resolution Mechanism

The ToR shall define a dispute resolution process that is effective and timely. The process shall provide clear written guidance for stakeholders to express dissenting views while encouraging meaningful discussion before implementing a dispute resolution mechanism. Alberta shall assist in dispute resolution by facilitating discussions between parties or providing advice. If Alberta is asked to arbitrate an *issue* or believes that arbitration is necessary, it shall provide direction that is final and binding on all parties.

2.0 Forest Management Plans

Although the standard speaks to FMPs generically, there are two types of FMPs to be considered - the preliminary plan and the detailed plan. A preliminary FMP is required for a newly established FMA. A preliminary FMP is prepared after an FMA has been allocated to guide forest management until a detailed FMP is approved.

2.1 Preliminary Forest Management Plan

The preliminary FMP is a simplified plan that establishes an *annual allowable cut (AAC)*, the ToR for the detailed FMP and some initial management strategies. Public participation is advised but not mandatory for preliminary FMPs. Alberta shall not grant *harvest level* increases based on preliminary FMPs. A preliminary FMP shall contain the following:

i. a brief description of the area
ii. the current Timber Supply Analysis (TSA) for the area
iii. the ToR for the detailed FMP
iv. initial values, objectives, indicators and targets (VOIT)
v. *spatial harvest sequence*

2.2 The Detailed Forest Management Plan

The detailed FMP shall address all components of CSA Z809-02 standard 7.3.7.

2.2.1 A Comprehensive Description of the DFA

2.2.1.1 Corporate Overview

Provide a brief (generally one page) background of the Organization and all forestry operators with timber allocations in the DFA. The overview may include acknowledgement of the entire corporation but should focus on Alberta operations and specifically on the mill(s) and products associated with the FMA.

2.2.1.2 Forest Management Approach

Describe the general approach being implemented and any differences between operators (e.g., coarse filter, fine filter, single landbase, natural disturbance paradigm, organization of FMUs/SYUs, commitment to SFM policy).

2.2.1.3 Landscape Assessment

See Appendix A for required contents of landscape assessment.

2.2.2 A Summary of Any Previous Forest Management Plan and the Management Outcomes Including the Learning Associated with Management Review

Include a description of performance with respect to past plans, and significant events affecting the DFA since the last plan. Significant events include such items as wildfires, insect infestations and land withdrawals. Describe how results are addressed in this plan.

2.2.3 A Statement of Values, Objectives Indicators and Targets

The Organization shall adopt a list of values objectives, indicators and targets shown in Annex 4, which are the minimum VOITs required. It is expected that additional VOITs, specific to the DFA, shall be added during the planning process.

2.2.4 Current Status and Forecasts for Each Indicator, Including a Description of the Assumptions and Analytical Methods for Forecasting

The Organization shall provide forecasts for each indicator as per CSA Z809-02 standard 7.3.6.4. The FMP submission shall contain a description of the analyses conducted as required in Annex J.

2.2.5 A Description of the Chosen Strategy Including All Significant Actions to be Undertaken and their Associated Implementation Schedule

Present the rationale for the chosen strategy and provide an action plan to implement the chosen strategy. The rationale must have enough detail and supporting data for the reader to clearly understand what was considered and why and how the chosen strategy addresses the VOITs.

2.2.6 A Description of the Monitoring Program and the Associated Evaluation of Actual and Expected Outcomes

Submit a Stewardship Report every five years. This shall be the primary mechanism for evaluating variance and corrective action. Annual Reports on some indicators are also required. Reporting schedules shall follow the timber year (May 1 to April 30) unless an alternate proposal by the Organization is presented and approved in the FMP.

2.2.7 A Demonstration of the Linkages between Short Term and Operational Plans and the SFM Plan

Describe how operational plans are linked to the FMP. The primary mechanisms for linkage are the *spatial harvest sequence*, silviculture prescription commitments and OGRs.

Appendix A – Landscape Assessment Standards

1.0 The landscape assessment includes complete information presented in suitable text, tabular and map formats.

The landscape assessment shall provide the following information:

1.1 Administrative boundaries, including:

i. *Forest management agreement(s)*;
ii. Defined forest area;
iii. Forest management units, sustained yield units, compartments/subunits;
iv. Natural sub-regions;
v. Municipal districts/counties;
vi. Federal government lands;
vii. Indian reservations;
viii. Protected areas and parks;
ix. Wildfire management areas.

1.2 Physical conditions, including:

i. Topography;
ii. Soils and landforms;
iii. Hydrography;
iv. Climate.

1.3 Forest landscape *pattern* and structure, including:

i. Forest species (amount and distribution);
ii. Forest covertypes (categories, amount and distribution);
iii. Forest age-classes (amount and distribution);
iv. *Seral stages* (define, amount and distribution);
v. Forest patches (size, shape, *connectivity*, association with specific landscape *features*);
vi. Spatial and *temporal* variability of cover types and *seral stages*.

Note: Ensure this information is reported with the same level of detail as required by the Performance Standards (Annex 4, see "Indicator" and "Target" fields)

1.4 Forest landscape disturbance and succession, including:

i. Inherent disturbance regime (e.g., size and frequency of fire, *insects and diseases*, floods, wind events);
ii. *Insects and diseases* (pest infestations and pest risk assessments);
iii. Invasive exotic species (infestation and risk assessment);
iv. Forest succession trajectories (processes, amount and *temporal* distribution);
v. Timber harvesting (amount and distribution);
vi. Forest industry access;
vii. Industrial development (access, infrastructure, dispositions);
viii. Monitoring sites.

1.5 Landscape Fire Assessment (see Annex 3, FireSmart Landscapes).

1.5.1 Wildfire Threat Assessment that includes;

i. Fire behaviour potential;
ii. Fire occurrence risk;
iii. *Values at risk*;
iv. *Suppression capability*.

1.5.5 Fire Regime Analysis that includes;

i. Fire season;
ii. Fire type;
iii. Fire severity;
iv. Fire size;
v. Fire frequency;
vi. Burn probability.

1.6 Land use, including:

- i. Timber;
- ii. Trapping;
- iii. Grazing;
- iv. Oil and gas industry;
- v. Recreation;
- vi. Tourism;
- vii. Outfitting;
- viii. Cultural resources;
- ix. *Historical resources*;
- x. Visual resources;
- xi. Fish and wildlife *resources*;
- xii. Government (Municipal, counties, federal, Indian reservations, provincial);
- xiii. Protected areas and parks.

Appendix B - Alberta Definitions[1]

Term	Definition in the context of this standard
Accurate (work)	- Is free of errors or omissions and is submitted on time. It is recognized that mistakes will occur occasionally. Prompt notification and correction of mistakes when discovered is the appropriate action. - Deviates from a standard only within acceptable limits, as specified by Alberta. Technical standards and tolerance limits in existing Acts, regulations, policies, directives, guidelines, ground rules and approved plans will be amended from time to time by Alberta. - Contains sufficient information to be readily understood. Complete documentation and explanation of work is demonstrated.
Adaptive management	The process of planning activities, implementing activities, monitoring results and comparing against planned results, and taking corrective action where unplanned results occur.
Aesthetic(s)	(a) Generally the study, science or philosophy dealing with beauty and with judgments concerning beauty. (b) Giving visual pleasure. (c) The theory of perception or perceptibility.
Agreement-in-principle	Alberta's notice (not approval) to the Organization that what has been prepared is acceptable at that point. The component is subject to review at a later date and may require revision if supporting information is not provided.
Alberta	The Department of Sustainable Resource Development, including the Public Lands and Forests Division, Fish and Wildlife Division, Forest Protection Division, or as amended from time to time.
Alberta vegetation inventory	An inventory of vegetation and forest stands.
Alberta Vegetation Inventory (AVI) update	The maintenance of an approved AVI coverage by mapping the changes that occur to the AVI as a result of anthropogenic (e.g. timber harvesting or land use activities) or natural disturbance, re-vegetation by planting or natural means, or the growth and/or succession of stands of trees or other vegetation, using approved AVI classification and mapping standards.
Alberta Vegetation Inventory re-inventory	The process of re-mapping an area previously mapped to AVI standards according to current AVI standards using new aerial photography. Where appropriate, the original AVI polygon boundaries are retained. Once approved, the new AVI coverage will replace the original.
Alternative Regeneration Standards	Requirements to be achieved for the reestablishment of forests on Crown land that may apply to an FMA or a larger regional area. These requirements, when approved by Alberta replace those established by the Alberta Regeneration Survey Manual.
Analysis	A detailed examination of a body of data, a series of decisions, or the implications of one or more policies, and a determination of what this examination reveals about the nature, function and/or relationships in effect.
Annual allowable cut	The volume of timber that can be harvested under sustained-yield management in any one year, as stipulated in the pertinent approved forest management plan. In Alberta it is the quadrant cut divided by the number of years in that quadrant, usually five.
Annual operating plan	A plan prepared and submitted by the forest operator each year. An AOP approved by Alberta provides the authorization to harvest. The AOP is a requirement of the Timber Management Regulation. (See section B 1.4)
Approval	Issued by Alberta. Approval Decisions grant approvals to FMPs and outline significant items considered in plan approval and state conditions to be met within specified time periods by the Organization. AOPs are subject to a review by Alberta prior to approval.
Area manager	The senior Alberta manager located at a Forest Area charged with supervision of all forest management activities in a Forest Area. It may also mean someone else who is authorized to approve an AOP.
Assumptions	A judgmental decision made by a planner or decision maker that supplies missing values, relationships, or societal preferences for some informational component(s) necessary for making a decision.
Biological diversity	The variety, distribution and abundance of different plants, animals and microorganisms, the

[1] Definitions of other terms are found in Alberta forestry statutes and the Alberta Interpretation Act.

(biodiversity)	ecological functions and processes they perform, and the genetic diversity they contain at local, regional or landscape levels of analysis. Biodiversity has five principal components: (1) genetic diversity (the genetic complement of all living things); (2) taxonomic diversity (the variety of organisms); (3) ecosystem diversity (the three-dimensional structures on the earth's surface, including the organisms themselves); (4) functions or ecological services (what organisms and ecosystems do for each other, their immediate surroundings and for the ecosphere as a whole; i.e., processes and connectedness through time and space); and (5) the abiotic matrix within which the above exists, with each being interdependent on the continued existence of the other.[2]
Buffer	Used in several contexts, as follows: (1) In protecting critical nesting habitat areas, the buffer is an area of forest land that reduces the impacts of adjacent activities on the critical area. The dangers associated with adjacent disturbances might include wind-throw or wind damage to nest trees and young birds in the nest, increased predation and loss of interior forest conditions. (2) A strip of land between two areas under different management regimes. Pesticide buffer zones are used to limit the possible drift, run-off or leachate of pesticide from a site into other areas, such as waterbodies or creeks. Streamside buffers are used to limit the effects of logging on creeks, such as siltation, loss of shading, loss of nutrient inputs from trees and degradation of riparian zones. The size and composition of the buffer zone depends on its intended function. (3) An area maintained around a sample or experimental plot to ensure that the latter is not affected by any treatment applied to the area beyond the buffer. (4) In GIS work, a new polygon computed on distance from a point, line or existing polygon. (5) In managing biosphere reserves, an area or edge of a protected area. Examples of compatible activities might include tourism, forestry, agroforestry, etc. The objective of the buffer zone is to provide added protection for the core reserve area. [2]
Calibration	The process of adjusting numerical or physical modelling parameters in a computational model for the purpose of improving agreement with data (e.g. data from a local area or condition) that may differ from the data on which the model was based. The objective of calibration is to improve computational results rather than to assess error and uncertainty. Reference: http://www.grc.nasa.gov/WWW/wind/valid/tutorial/glossary.html
Clearcutting	A regeneration system where all or most of the merchantable trees in a defined area are harvested in one cutting with reproduction obtained through artificial or natural means.
Coarse filter management	Conservation of land areas and representative habitats with the assumption that the needs of all associated species, communities, environments and ecological processes will be met. [2]
College	The College of Alberta Professional Foresters (CAPF) or the College of Alberta Professional Forest Technologists (CAPFT).
Commercial thinning	A partial cut where trees of a merchantable size and value are removed to provide an interim harvest while maintaining a high rate of growth on the remaining, well-spaced, final crop trees. Used to capture volume likely to succumb to competition pressures and be lost to disease, insect, or dieback.
Compartment	A subsection of an FMA for which operational plans are developed.
Connectivity	A measure of how well different areas (patches or a landscape are connected by linkages, such as habitat patches, single or multiple corridors, or "stepping stones" of like vegetation. The extent to which conditions among late successional/climax forest areas provide habitat for breeding, feeding, dispersal and movement of late successional - or climax-dependent wildlife or fish species. Natural landscapes often tend to be better connected than those that have been heavily influenced and disturbed by human activities. Consequently, there is a body of opinion that the best way to avoid fragmentation of landscapes is to maintain, or re-establish, a network of landscape linkages. At a landscape level, the connectivity of ecosystem functions and processes is of equal importance to the connectivity of habitats. [2]
Constraints	The restriction, limiting, or regulation of an activity, quality or state of being to a predetermined or prescribed course of action or inaction. Constraints can be a result of policies or political will; management direction, attitudes and perceptions; or budget, time personnel and data availability limitations; or, more typically, a complex interaction of all these factors. [2]
Corrective actions	May include one or more of the following: - Direct that the work be corrected and re-submitted; - Carry-out an appropriate enforcement response; - Refer the matter to the Complaints Director of the appropriate College to investigate the

	complaint.
Corridor	1 A physical linkage connecting two areas of habitat and differing from the habitat on either side. Corridors are used by organisms to move around without having to leave the preferred habitat. A linear habitat patch through which a species must travel to reach habitat more suitable for reproduction and other life sustaining needs. Many corridors, linking several patches of habitat, form a network of habitats. The functional effectiveness of corridors depends on the type of species, the type of movement, the strength of the edge effects and its shape. 2 An area of uniform width bordering both or one side of a lineal feature, such as a stream or route.
Culmination age	The age at which the stand, for the stated diameter limit and utilization standard, achieves its maximum average rate of volume production (the Mean Annual Increment, or MAI is maximized.
Cut control period	A period of 5 consecutive forest management operating years or other period agreed to by the Minister.
Desired future forest	A spatially explicit projected range of conditions of the forest landscape 100+ years into the future. The range of forest conditions defines the goal towards which forest management will be directed. It is the Organization's best estimation for the arrangement of forest age classes, roads and habitats that will provide a suite of desired outcomes identified for the area through a forest management planning process.
Detailed forest management plan	A long-term plan used to outline higher-level management objectives, sustainability and timber production assumptions for a Forest Management Agreement.
Downed woody debris	Woody material >1cm in diameter, stumps and snags < 1.3 m tall and dead trees leaning >45 degrees. The woody material left on site after logging including both pre-existing and harvest-generated material (downed boles, limbs, tops and stumps). Includes highly decomposed and vegetated material as long as it is recognizable as being woody.
Due diligence	- Taking and documenting steps to ensure the desired outcome is achieved or the chances of a negative consequence or outcome are minimized. - Ensuring completeness, correctness, consistency and repeatability. - Demonstrating how conclusions were reached. - Using mechanisms such as but not limited to checklists and standard operating procedures, to demonstrate that appropriate procedures were followed and to ensure that no relevant steps or considerations were missed. - Keeping and maintaining appropriate files and filing systems as well as document retention policies and practices.
Enhanced Forest Management	Improvements in forest growth resulting from thinning, fertilizing, tree improvement or drainage.
Estimation	The statistical process of deriving coefficients for models e.g. to define the growth rates as a function of measured tree, site and stand variables. Reference: Bruce, D. and L.C. Wensel. 1987. Modelling forest growth: approaches, definitions and problems. USDA For. Serv. Gen: Tech. Rep. NC-120.
Evaluation	Is considering how, where and by whom a model should be used, how the model and its components operate, and the quality of the system design and its biological realism. Evaluation[3] of a model involves several steps including verification and validation. In forest growth modelling, verification and validation denote qualitative and quantitative tests of the model, respectively. Reference: Bruce, D. and L.C. Wensel. 1987. Modelling forest growth: approaches, definitions and problems. USDA For. Serv. Gen. Tech. Rep. NC-120.
Features	The features represented on a map which describe the physical aspects of the harvest design. E.g. harvest area boundaries, roads, buffers, wildlife habitat.
FireSmart community zone	A standard 10 kilometre radius around the community extending from the Wildland Urban Interface Zone. A unique data set will be gathered for this zone for community protection planning to provide a fundamental linkage between FireSmart Communities and FireSmart Landscapes
FireSmart landscape zone	This zone extends beyond the FireSmart Community Zone overlapping multiple jurisdictions at a broad landscape level. This zone focuses on mitigating the likelihood of large, high intensity,

[3] Vanclay, J.K. and J.P. Skovsgaard. 1997. Evaluating forest growth models. Ecological Modelling 98 (1997) 1 – 12.

	high severity fires. Fire, Forest and Land Management planning are integrated and designed to reduce the negative ecological, economic and social impacts of wildfire while maximizing the positive attributes of wildfire.
FireSmart landscapes	The philosophy that seeks to mitigate the likelihood of large, high intensity and high severity fires. FireSmart landscapes are designed to recognize the interaction between ecological, economic and social impacts, hence maximize the positive ecological impacts and minimize the negative economic and social impacts.
Forest health	A condition of the forest; a forest is considered healthy if it can sustain itself to meet the specific forest land management objectives of today or in the future.
Forest management agreement	A contract between the province of Alberta and the FMA holder whereby the province provides an area-based Crown timber supply. In return, the FMA holder commits to the following: Managing the timber resource on a perpetual sustained yield basis, taking into consideration a broad range of forest values in determining forest management practices. Meeting defined economic objectives, including capital investment and job creation, and seeking out new business opportunities that provide measurable economic benefits for both the province and the FMA holder. The FMA gives the FMA holder the right to access Crown fibre. In return, the FMA holder commits to forest management responsibilities, which may change from time to time.
Forest management plan	Generic term for Preliminary Forest Management Plans, Detailed Fores. Management Plans, Forest Management Unit Plans, General Development Plans, and Annual Operating Plans.
Forest management unit	An administrative unit of forest land designated by the Minister, as authorized under Section 14(1) of the *Forests Act*.
Forests Act, the	The legislative statute that authorizes the Minister to administer and manage the forested lands of Alberta.
Full review	An evaluation of the acceptability for approval of a submitted document involving referrals to government departments, independent experts, or others as appropriate, and a risk analysis prior to Alberta granting approval to the submitting Organization.
Genetic diversity	The genetic variability within a population or a species; the number and relative abundance of alleles. Genetic diversity can be assessed at three levels: Diversity within breeding populations, Diversity between breeding populations within any one geographic area, Diversity within the species
Green-up period	The time needed to re-establish vegetation after a disturbance. Specific green-up periods may be established to satisfy visual objectives or hydrological requirements, or as a means of ensuring re-establishment of vegetation (for silviculture, wildlife habitat or hydrological reasons) before adjacent stands can be harvested.
Ground Rules	See Timber Harvest Planning and Operating Ground Rules
Growing stock	The sum (by number, basal area or volume) of trees in a forest or a specified part of it.
Guideline(s)	A preferred or advisable course of action respecting land and resource management. Guidelines imply a degree of flexibility, based on administrative judgment or feasibility of applying the guideline, and are consequently not normally enforceable through legal means.
Harvest area	A specified land area with defined boundaries where timber harvesting is scheduled, or has occurred. (commonly referred to as a cut block)
Historical resources	Any work of nature or man that is primarily of value for its palaeontological, archaeological, prehistoric, historic, cultural, natural, scientific or aesthetic interest, including, but not limited to, the structure or object and its surrounding site.
Interpretive bulletin	Document issued from time to time by Alberta describing protocols, standards, methods or other applicable to forest management planning.
Harvest level	A volume or area of timber determined through timber supply analysis available for harvest on an annual sustainable basis within a DFA. A harvest level is not an AAC unless approved by the Minister.
Inoperable	Classification of a forest site based on the potential to harvest timber on that site, as affected by physiographic characteristics, moisture regime and harvesting equipment/technology.
Insects and diseases	Biological, physiological, and environmental agents that have an adverse effect on the health of the forest. These agents include insects; nematodes; micro-organisms (viruses, bacteria, fungi); parasitic plants; mammals; birds; and non-infectious disorders caused by climate, soil, applied

	chemicals, air pollutants and other physiographic conditions.
Interests	The wants, needs, concerns and desires of each party that provide motivation to be concerned about an issue or topic.
Issue(s)	The topic to be discussed. The problem to be solved. The theme of the discussion.
Landscape	A landscape (or LMU) is a heterogeneous area in which the pattern of the mosaic of local ecosystems or land uses is repeated in similar form throughout kilometres wide area (after Forman 1986). Landscapes may coincide with a climatic, physiographic or ecological boundary. However, landscapes are not strictly ecologically based and include human use and modification of the area.
Landscape fire assessment	Information on the effects of fire which may be used to influence forest management strategies and tactics over a landscape. The wildfire threat component of the landscape fire assessment handles the negative aspects of fire, and fire regime analysis handles the positive attributes. Both "wildfire threat" and "fire regime" need to be considered in order to provide a balanced "landscape fire assessment."
License of occupation	A disposition issued by Alberta authorizing occupation of a linear corridor, often for an access road.
Mean annual increment	The average annual increase in volume of individual trees or stands up to the specified point in time. The MAI changes with different growth phases in a tree's life, being highest in the middle years and then slowly decreasing with age. The point at which the MAI peaks is commonly used to identify the biological maturity of the stand and its readiness for harvesting.
Meaningful Consultation	Consulting in good faith, with honest communication and an open exchange of relevant information before decisions are made.
Metadata	Data that describes the content, quality, conditions, use limitations and other characteristics of a dataset and which also documents bibliographic information including but not limited to a dataset such as who collected the data, when it was collected, how it was collected, pre-processed and converted, its resolution and who presently holds the data. In summary, metadata is information about a thing, apart from the thing itself.
Maximum mean annual increment	The volume available at the culmination of mean annual increment. The volume/ha described by the point on a volume/ha:age graph where the curve of mean annual increment crosses the curve of the current annual increment (CAI).
Model	A representation of a physical system or process intended to enhance our ability to understand, predict or control its behaviour. Forest growth models are usually a mathematical function, or systems of functions, used to relate actual growth rates to measured tree, stand or site variables. Reference: http://www.grc.nasa.gov/WWW/wind/valid/tutorial/glossary.html
Monitoring	The continued checking of output of a system to detect shortcomings of the model. "Growth-and-yield monitoring" is the process of comparing the observed to the predicted growth and yield for a stand or forest area.
Noxious weed	A plant designated under the Weed Regulation (AR 171/2001) of the Weed Control Act.
Organization	The industrial proponent charged with developing the FMP.
Partial cutting	A treatment where significantly less than 100% of the trees are harvested from a stand or area. It includes commercial thinning, even when the intention is leading to a final clearcut.
Pattern	The arrangement of forest stands or harvest units.
Permanent sample plots	A fixed or variable area plot established for (forest) sampling and measurement purposes, and designed for remeasurement.
Planning horizon	The length of time over which a series of defined management actions occur. For the purposes of modeling - 200 years.
Precautionary AAC	A level of harvest set that minimizes the risk of negatively impacting forest resources from an inadequately justified management assumption or in the absence of a comprehensive DFMP for the DFA.
Pre-commercial thinning	A silvicultural treatment to reduce tree density in young stands, carried out before the stems reach merchantable size. The intent is to concentrate the site's growth potential on fewer trees thereby accelerating stand development and reducing the time to final harvest, retaining more live crown, creating opportunities for future commercial thinning activities and improving stand operability.
Preliminary forest management plan	A plan submitted by FMA holders within 12 months of signing a new agreement (includes a major revision to an existing agreement). It establishes an interim harvest level and cut

	sequence complete with justifications. This plan is the basis for harvest authorization until replaced by the Detailed Forest Management Plan.
Prescribed burn	The planned use of carefully controlled fire to accomplish predetermined management goals (e.g., site preparation for planting, reduction of fire hazards or pest problems, improvement of the ease with which the site can be traversed, and creation of better quality browse for wildlife). [2]
Quota	The timber quota is a share of the allowable cut of coniferous timber within a forest management unit.
Regeneration	The renewal of a tree crop by natural or artificial means. It may also refer to the young crop itself.
Regulated forestry professional	A Registered Professional Forester (RPF) on the Registered Professional Foresters Register of the College of Alberta Professional Foresters (CAPF) or a Registered Professional Forest Technologist (RFPT) on the Registered Professional Forest Technologists Register of the College of Alberta Professional Forest Technologists (CAPFT).
Residual structure	Standing structure that is taller than 2 m, within a harvested area. Areas buffered for sensitive ecological or wildlife habitat may be included for residuals. Required buffers for lakes and small and large permanent streams are not included. This includes non-merchantable trees and shrubs, live merchantable trees, snags and stubs.
Residual tree	A live canopy tree that is spatially within a harvested area. Areas buffered for sensitive ecological or wildlife habitat may be included for residuals. Required buffers for lakes, small and large permanent streams are not included.
Resources	Physical and intrinsic features of the land, including but not limited to timber, wildlife, water and soil.
Review	Acceptance or appraisal conducted by Alberta
Rotation	The period of years required to establish and grow even-aged timber crops to a specified condition of maturity.
Selection harvesting	A silvicultural system used to create or maintain uneven aged stands. Usually accomplished through the periodic removal of groups of trees or individual trees, while full residual stand growth rates are maintained and natural regeneration from overstorey trees is encouraged. Not to be confused with selective harvesting, or high-grading, where trees are selected and removed periodically based solely on economic criteria. Selective harvest is not designed to improve the growing conditions of the remaining crop trees as Selection harvest is.
Sensitive sites	Sites that have soil, water, slope, aesthetic, vegetation or wildlife characteristics that require special protection beyond the normal precautions described in the ground rules. They may be complex if many values or issues are involved.
Sensitivity analysis	An analytical procedure in which the value of one or more parameters is varied; the changes that this produces are analysed in a series of iterative evaluations. If a small change in a parameter results in a proportionately larger change in the results, the results are said to be sensitive to the parameter.
Seral stages	A stage in forest succession. A series of plant community conditions that develop during ecological succession from a major disturbance to the climax stage. Most common characteristics/classifications include tree species and age.
Silviculture	The theory and practice of controlling the establishment, composition, health, structure and growth of forests in order to achieve specified management objectives.
Site preparation	Any action taken in conjunction with a reforestation effort (natural or artificial) to create an environment favourable for survival of suitable trees during the first growing season. Altering the ground cover, soil or microsite conditions can create this environment; using biological, mechanical or manual clearing; prescribed burns; herbicides or a combination of methods. [2]
Slenderness coefficient	The ratio of height to diameter at breast height. Used to estimate windthrow and breakage potential of a stand.
Soil productivity	The capacity of a soil to provide for growth.
Spatial	Of, or existing in, space. [Webster's]
Spatial Harvest Sequence	A stand level map depicting forest stands scheduled for timber harvesting that are feasible to be operated by the organization. SHSs are generally prepared for 20 years.
Species at risk	Any species known to be "at risk" after formal detailed status assessment and designation as "Endangered" or "Threatened" in Alberta. The list of species is maintained by Alberta.

Species of management concern	Species within the forest management planning area that have an identified value (social, economic, ecological) and are managed to ensure their continued protection and/or use. This includes species that are hunted or trapped, as well as those that are endangered or threatened.
Stand	A community of trees sufficiently uniform in species, age, arrangement or condition as to be distinguishable as a group in the forest or other growth in the area. A stand may also be that polygon as defined in the AVI or Phase III inventory.
Suppression capability	The effectiveness of traditional fire suppression tactics. It is an objective evaluation of initial attack response time, access for ground support resources, water availability and terrain which might adversely impact movement of resources.
Sustainable forest management	Management to maintain and enhance the long-term health of forest ecosystems, while providing ecological, economic, social and cultural opportunities for the benefit of present and future generations.
Temporal	Of, or limited by, time. [Webster's]
Timber disposition holders	Includes quota holders, permittees and other industrial operators with dispositions located within a Forest Management Agreement Area.
Timber Harvest Planning and Operating Ground Rules	Standards for operational planning and field practices that must be measurable and auditable and based forest management plan objectives.
Timber Management Regulation	The legislative statute that describes the mechanism and regulations by which the forested lands of Alberta are managed. The Regulation is associated with the Forests Act.
Timber operations	Includes all activities related to timber harvesting including site assessments, planning, road construction, harvesting, reclamation and reforestation.
Timber supply analysis	Calculations/computer models with built-in assumptions regarding forest growth patterns, used to determine the annual allowable cut.
Understorey	The trees and other woody species growing under the canopies of larger adjacent trees and other woody growth[2].
Utilization	The portion of the stand or individual tree used for manufacture of wood products, defined in terms of piece length and diameter at each end. Minimum standards for utilization are defined in the timber disposition.
Validated work (Validation)	Work that has been prepared by, or reviewed and approved by an RFP. These professionals are subject to an enforceable code of ethics and standards of practice and are expected to complete their work with due diligence to ensure such work is accurate. The RFPs who validate the work may have done the work themselves, contracted the work to be done, or supervised those who did the work, but in any case, the validating RFPs are accountable for the work being prepared with due diligence and being accurate. If more than one RFP is involved in preparing the work, the RFP that is most directly involved in the work is to validate the work.
Validation	The process of determining the degree to which a model is an accurate representation of the real world from the perspective of the intended uses of the model i.e. testing a model to see how well it predicts. Whenever possible, testing is done against an independent data set. If that is impossible, the data set available to the modeller is often split into two subsets, one to be used for model development and thither for model testing. Reference: http://www.grc.nasa.gov/WWW/wind/valid/tutorial/glossary.html
Values at risk	A listing of values which may be at risk of being reduced by wildfire. In order to complete a spatial "priority" evaluation, information regarding values is required.
Variance	Any change from a planned activity or result as compared to the actual activity or result. Variance refers to the actual total change not net change. (i.e., cumulative not compensatory, Two individual variances of (+5) and (-5) = a total variance of 10, not zero)
Variance – spatial harvest sequence	1. Operators shall delete no more than 20% of the area (ha) of the scheduled stands in the approved spatial harvest sequence. 2. Operators may replace up to an equivalent area (ha) deleted from unsequenced stands in the net landbase. 3. Operators may harvest no more than 100% of the total area (ha) sequenced in the spatial harvest sequence. 4. Items 1, 2 and 3 above, must be met by compartment per decade.
Verification	The process of determining if a model implementation accurately represents the developer's description of the model and the solution to the model. This often involves testing a model

	with the data on which it is based to eliminate lapses in programming logic, flaws in algorithms, and bias in computations. Verification implies truth, but it is generally impossible to prove a model is 'true'. The only truth that can be established in a growth model (e.g. in the context of Goulding (1979) is that a model is a faithful representation of what the modeller intended. Reference: Goulding, C.J. 1979. Validation of growth models used in forest management. N.Z. J. For., 24: 108 – 124.
Visual quality objectives	Broad objectives for visual resource management that set limits considered acceptable to the average viewer, as to the form and scale of visible alteration.
Visual resource inventory	A quick and simple process of recording the expanses of viewable area, noting key features, their prominence and sensitivity in order to better direct proposed harvesting operations in scenic or visually important areas.
Water availability	Availability of water which can be utilized for fire suppression.
Watercourse	The bed, bank or shore of a river, stream, creek or lake or other natural body of water, whether it contains or conveys water continuously or intermittently.
Watershed	An area of land, which may or may not be under forest cover, that drains water, organic matter, dissolved nutrients and sediments into a lake or stream. The topographic boundary, usually a height of land, that marks the dividing line from which surface streams flow in two different directions.
Wildland urban interface	The area where various structures and other human developments meet or are intermingled with the forest and other vegetative fuel types.
Wildlife	Any species of amphibian, bird, fish, mammal and reptile found in the wild, living unrestrained or free roaming and not domesticated. Some definitions include plants, fungi, algae and bacteria.
Yield curve	Graphical representation of a yield table.

List of Initialisms

AAC	Annual Allowable Cut
AOP	Annual Operating Plan
ARS	Alternative Regeneration Standards
BOR	Basic Operating Rules
CAPF	College of Alberta Professional Foresters
CAPFT	College of Alberta Professional Forest Technologists
CCFM	Canadian Council of Forest Ministers
CT	Commercial Thinning
CTP	Commercial Timber Permit
CSA	Canadian Standards Association
C&I	Criteria and Indicators
DFMP	Detailed Forest Management Plan
EFM	Enhanced Forest Management
FMA	Forest Management Agreement
FMP	See definitions - Forest Management Plan (generic)
FMU	Forest Management Unit
G&Y	Growth and Yield
GDP	General Development Plan
IRP	Integrated Resource Management Plan
LOC	Licence of Occupation
MAI_{Max}	Maximum Mean Annual Increment
PCT	Pre-commercial Thinning
PDT	Plan Development Team
PFMP	Preliminary Forest Management Plan
PPG	Public Participation Group
PSP	Permanent Sample Plot
RFP	Regulated Forestry Professional
RPF	Registered Professional Forester
RPFT	Registered Professional Forest Technologist

SAGD	Steam Assisted Gravity Drainage
SFM	Sustainable Forest Management
SHS	Spatial Harvest Sequence
SYU	Sustained Yield Unit
ToR	Terms of Reference
TMR	Timber Management Regulation, (Forests Act)
TSA	Timber Supply Analysis
TSP	Temporary Sample Plot
VOIT	Values, Objectives, Indicators and Targets
VQO	Visual Quality Objectives
VRI	Visual Resource Inventory

Alberta Forest Management Planning Standard

Annex 1

Timber Supply Analysis and Growth & Yield

Alberta Sustainable Resource Development
Public Lands and Forests Division
Forest Management Branch
Version 4.1 - April 2006

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Annex 1
Timber Supply Analysis (TSA) and Growth & Yield (G&Y)

Timber Supply Analysis Standards

Format for Annex 1

- Individual standards are numbered.
- **Bolded text** indicates Alberta's primary interest.
- Plain, numbered text presents specific requirements of the standard.
- Text without numbers contains additional detail that clarifies the requirements necessary for meeting the standard.
- General headings are italicized.

Annex 1 contains the standards for efficient completion of timber supply analyses and forecasts for the *desired future forest*.

Timber supply analysis has four stages requiring Alberta's approval:

1. Landbase description
2. Yield projection
3. Forecasting
4. Harvest planning

Alberta's objective is to select a *sustainable forest management* scenario that will require minimal changes until the next management plan is approved.

1.0 General Standards

1.1 All submissions related to TSA requiring Alberta's approval are validated by a RFP.

i. Alberta shall not initiate a review of submissions until RFP-validated submissions are received.

The validating RFP is responsible for ensuring the standards in this annex are met. Alberta shall review submissions in one of two ways:

a) by conducting assessments of accuracy, or
b) through comprehensive appraisals of *validated work* where, in Alberta's opinion, there is risk of significant negative impacts.

Although reviews will not start until validated submissions are received, effective and on-going communication between parties is required during development of the submissions.

1.2 All submissions meet Alberta's requirements.

The requirements are:

i. All submissions contain RFP-validated checklists[1].
ii. All submissions are in formats and on media approved by Alberta.
iii. All data used in preparing the FMP must be provided to Alberta on request.
iv. All submissions must include documentation of sufficient detail to enable Alberta to understand and replicate the submission without additional clarification.
v. When one or more changes to submissions are made, the entire work shall be resubmitted.
vi. One single digital copy of work shall be submitted to Alberta.
vii. All submissions shall be labelled accurately.
viii. All data used in the analysis must be included in the submission to Alberta for *verification*.
ix. Models or analysis systems used in a submission must be approved by Alberta, prior to use.
x. The Organization shall initiate its submission by making a comprehensive presentation of the work and data to Alberta and all affected stakeholders.
xi. Each data set submitted shall include a data dictionary with the following information:

[1] To be developed and approved in Terms of Reference.

b. File name
c. File type
d. Name and version of the software used to create the file

xii. For each field, the following must be provided:
a. Field name
b. Field length
c. Number of decimal places (where applicable)
d. Description/definition of field
e. Valid codes
f. A description/definition for each valid code
g. A description of any processes or calculations used to create derived data

It is imperative that details related to software and hardware are explained clearly to minimize delays. Since new versions and different types of data storage hardware and media are readily available, the ToR for the FMP shall state the types of media and data formats to be used, or identify the time during the planning process when this matter will be addressed. Multiple versions of data resulting from successive submissions may result in a delay owing to the additional work it creates for Alberta reviewers. Detailed labelling and controlling the number of copies submitted is essential for expediting reviews.

Alberta considers instances where the documentation provided is found to be inconsistent with the process actually used, to be a significant inaccuracy.

The Government of Alberta has passed the Freedom of Information and Protection of Privacy Act (the "Act"). All records (as defined in the Act) submitted to Alberta are subject to the Act and may be the subject of requests for access under the Act. The Act prohibits the disclosure of business information where disclosure would be harmful to a company's business interest (as defined in section 16 of the Act).

Organizations must be aware of their obligations under this act and copyright legislation. Alberta will honour licensing agreements that affect the data and software used.

Alberta will not:
i. proceed with its review until all necessary information has been provided.
ii. approve submissions where it considers the information to be inadequate.

2.0 Vegetation Inventory Standards

Alberta's objective is to ensure vegetation inventories used are maintained, and updated.

2.1 The vegetation inventory used in the FMP has been approved by Alberta.

The *Alberta Vegetation Inventory (AVI)* is the inventory standard for the foreseeable future. Alberta believes it is desirable to have in place a credible and cost-effective system for updating AVI to further enhance its utility. Alberta will publish a vegetation inventory and update standard and forest management directives from time to time to address update mechanisms and standards.

The *Alberta Vegetation Inventory (AVI)* is a critical input for a FMP since the stand attributes shall be used to forecast the *desired future forest* conditions, to implement the FMP through the *spatial harvest sequence*, and to complete more detailed operational planning. Any shortcomings or deficiencies found in the AVI must be addressed promptly in an update process approved by Alberta.

The ToR for the FMP shall identify and allow time to complete the inventory, inventory updates and approval. The AVI approval is a separate, pre-requisite process to the FMP approval process. If additional information is to be used in the FMP (e.g., *understorey* inventories) the inventory

methodology and resulting data must be approved by Alberta, and any process used to convert such information into an approved format must be documented fully.

2.2 A description of the history of the vegetation inventory completed within the FMA is complete and *accurate*, and a description of the inventory update process used is included.
Provide an explanation of all updates performed on the AVI data following the date of photography used in the original photo-interpretation, and a description of the process used to convert the inventory used by the Organization to the standard published by Alberta. The description shall accompany the submission of the AVI data used in determining the net landbase.

2.3 The effective date of the inventory is no more than 2 years prior to the submission date of the FMP.

2.3.1 Depletions are current as of the effective date.
(e.g., harvest areas, fires, *insects and diseases*, blowdown, allocations to other land uses)

2.3.2 The forest cover typing in the AVI used in a FMP has been updated according standards approved by Alberta, and no more than 10 years prior to the effective date.

2.3.3 *Metadata* is complete and *accurate* and includes information such as inventory version, photography dates, and inventory approval dates.

2.3.4 The Terms of Reference addresses the need for an *understorey* inventory.

2.3.5 *Understorey* classification has been completed according to standards approved by Alberta.

3.0 Landbase Description Standards

These standards describe the procedure and steps required to establish the net landbase and report the spatial classified landbase. A review of the landbase description shall not begin until the AVI has been approved. *Agreement-in-principle* of the landbase description and yield projections shall be concurrent.

3.1 Descriptive information has been provided to Alberta.
Other pertinent data may also be provided, (e.g., land use updated, ecosites, wildlife habitat, visual *resources*, soils, terrain).

i. Description outlining type and purpose of data set (e.g.; land use update).
ii. Level of accuracy of data collection (i.e., scale).
iii. Age or collection date.
iv. Data source.
v. Description of how data is used in the TSA and spatial *harvest sequence*.
vi. Copies of additional data sets used during the landbase classification process have been provided to Alberta as requested.

3.2 The net landbase includes all lands available for timber harvesting.
The net landbase (also referred to as active, or contributing) is the landbase available for timber harvest and comprises the net productive coniferous and net productive deciduous land bases. The remaining lands are those that are not part of the net productive coniferous or deciduous land bases (passive, or non-contributing).

i. All land area in the DFA must be assigned to either the contributing (net landbase), or non-contributing landbase and the net landbase file must have a field that distinguishes this.
ii. Linear developments (e.g. roads, pipelines, seismic lines, trails) not captured because the widths of these *features* are less than the minimum widths captured in AVI must be excluded from the net land base. Detectable seismic activity, captured in the provincial

base *features* access layer, must be removed from the net land base as an area-based deletion. The process for handling these *features* for inventory and volume sampling must be acceptable to Alberta, and described in the ToR.

iii. The following lands are included in the non-contributing landbase:

a. Crown land committed to other land uses and under other dispositions. (e.g., PNTs with surface restrictions, some grazing dispositions, DRS, Indian reserves, industrial sites [mills, mines], and other areas as outlined in pertinent Integrated Resource Plans [e.g., ESIP zones, ecological reserves]).

b. Existing parks, wilderness areas, conservation areas and other protected areas.

c. Non-forested land. Areas not occupied by productive forest cover (e.g., rock, ice, swamp, alpine areas and water bodies).

d. Private land

e. *Inoperable* areas due to slope and elevation *constraints*

f. Riparian buffers

g. Other buffers (e.g., roadside buffers or buffers around wildlife *features*)

h. Organization defined subjective deletions (i.e., forest types deleted due to one or a combination of the following: species, low volumes, and/or poor site productivity). (e.g., a stand description such as "larch or black spruce as primary or secondary species", TPR = "U", less than 5 m in height, and age of origin greater than 1900.)

3.3 The landbase data includes pertinent administrative zones, as outlined in the ToR.

Administrative data layers are required for analysis and spatial harvest planning in the TSA. These administrative units/zones/compartments must include as a minimum:

i. Current and proposed FMU boundaries.

ii. Sustained yield units, administrative units/zones/compartments that are used in harvest sequencing.

3.4 The landbase classification has been fully documented and is complete.

In addition to the General Standards 1.0 in this annex the documentation must include a description of how the FMP objectives have affected the classification and a thorough explanation of the methodology used to query and summarize each landbase classification category. The assignment of stands to a landbase classification is a primary *issue* that concerns all operators and must be addressed effectively.

3.5 Attribute data, and spatial data representing the final classified landbase, have been provided to Alberta.

3.6 The spatial data format and documentation for the classified landbase meets the requirements listed.

Unless otherwise approved in the ToR, the minimum requirements are:

i. ArcInfo export (.e00) format.

ii. Provide the ArcView shapefiles where they will be used as an input file for non-timber resource models or timber supply models.

iii. Report the projection and datum used (*e.g., UTM Zone 11 NAD 83*).

iv. Describe the tolerance parameters used in generating the final classified landbase.

v. Explain how sliver polygons were handled.

vi. Submit spatial and attribute data for the entire FMU or FMA (i.e., include contributing and non-contributing landbases) (See standard 5.6.2).

vii. There must be a direct relationship between the spatial data files and the final classified landbase attribute data file. The fields used to link the spatial data and attribute data must have the same field names.

3.7 The classified landbase file used in the TSA is complete and meets the submission requirements.

i. All fields used in the landbase classification process are included in the final classified landbase file.

ii. The file is submitted as a single flat table containing all the required information. Linked tables created using relational database software may be submitted to aid in the review process. Separate files may be submitted for separate FMUs or sustained yield units (SYU).
iii. The files must be in a digital format acceptable to Alberta.

3.8 Location information for every record in the final classified landbase attribute file is present.

Minimum required location information includes:

i. FMU
ii. Township
iii. Range
iv. Meridian
v. Stand/polygon number
vi. Sub-stand numbers/designation

3.9 Stand description requirements for the vegetation inventory have been met.

3.9.1 Where Phase 3 inventory is used, both overstorey and *understorey* descriptions must be present in the final classified landbase attribute file. The minimum stand description information required for Phase 3 data includes:

i. Density class
ii. Height class
iii. Species 1 to 4
iv. Commercialism
v. Origin
vi. Site
vii. Gross stand area

3.9.2 Where AVI is used, both overstorey and *understorey* descriptions must be present in the final net landbase attribute file in the following specified order. An explanation describing how horizontal stands are classified must be included.

i. Moisture regime
ii. Density class
iii. Height
iv. Species and species percentage 1 to 5

This information must be included in the understorey record as described above.

v. Stand structure and structure value
vi. Origin (date of stand origin – year)
vii. Timber Productivity Rating (TPR)
viii. Non-forested vegetation field and percentage cover
ix. Naturally non-vegetated field
x. Anthropogenic vegetated field
xi. Anthropogenic non-vegetated field
xii. Stand modifier 1 and modifier year
    a. Where stand condition modifiers (e.g., CC, BU, CL) take precedence over stand treatment modifiers
xiii. Stand modifier 2 and modifier year
    a. Where stand condition modifiers (e.g., CC, BU, CL) take precedence over stand treatment modifiers
xiv. Any additional standard AVI fields used in the classification process
xv. Gross stand area in hectares

3.10 Processed attributes approved by Alberta have been included in the classified landbase file.

Certain attributes used in timber supply analysis result from processing or manipulating basic inventory data. The rationale and methodology for creating these attributes must be provided. The processed attributes that must be included in the classified landbase attribute file include:

i. Yield stratum assignment

ii. Landbase assignment (i.e., coniferous or deciduous when applicable)
iii. Age-class assignment
iv. Net stand area
v. Field indicating whether the polygon is part of the net landbase (contributing) or non-contributing landbase.
vi. All inventory updates (e.g., cutblocks, land use, fires)
vii. All additional processed attributes used in the classification process
viii. All additional processed attributes that will be used as described in the FireSmart Management annex.
ix. Classification of reforested areas is consistent with reforestation records.
x. All additional processed attributes Alberta deems pertinent.

3.11 Harvested areas have been classified using the most current information on the harvest area.

The degree to which reforestation has been successful is a critical matter. The accurate classification of harvested areas is essential for management. Increasing amounts of the net landbase are being harvested and the management of these areas is a significant issue in forest management. Alberta's view is that the stand development trajectory can be established through reforestation survey information. The classification of harvest areas must be consistent with reforestation records and plans for the area. The requirements are as follows:

i. Areas harvested after March 1, 1991, shall be assigned to the yield stratum based on the regeneration stratum for the harvest area as defined in the Alberta Regeneration Information System (ARIS) and the most current information on the harvest area and its associated regeneration stratum in ARIS.

Harvest areas may be in one of the following phases:

a. Harvest Stratum Assignment - harvest area is less than 2 years old and has not received a stratum declaration (reforestation target) or initial establishment regeneration survey.

b. Stratum Declaration - area has been harvested, a reforestation stratum target has been declared, but harvested area has not received an initial establishment regeneration survey.

c. Establishment Surveyed - This is the first regeneration survey on an area. If the area is satisfactorily restocked (SR) to the stratum declaration, or not satisfactorily restocked (NSR) to any stratum, the stratum shall be the stratum declaration. If the area is NSR to the stratum declaration, but SR to alternate stratum it may be changed to the new stratum which becomes new reforestation target.

d. Performance Surveyed - This is the final regeneration survey and marks the end of the reforestation phase of a harvested area. The final stratum is determined, and may be different from the original stratum declaration, unless the performance survey result is NSR to any available stratum.

ii. Should AVI information not be available, or in Alberta's opinion, the survey information is outdated and inappropriate, Alberta will require that a conservative yield assumption be applied to pre-1991 harvest areas. Areas harvested prior to March 1, 1991 shall be assigned to a yield stratum based on the vegetation inventory in place on the effective date of the inventory, unless an alternate field survey approved by Alberta prior to the effective date demonstrates that an alternate yield curve is more appropriate. In this case, the Organization may also utilize an approved alternate survey to demonstrate a more appropriate yield curve and stratum assignment.

3.12 The distribution of the net landbase by FMU, sustained yield unit, single combined (deciduous/coniferous) landbase, or separate distinct deciduous and coniferous landbases, and for the entire area, has been submitted in a detailed table.

i. Summarized data must be consistent with summaries used for determining the net landbase and processed attributes.

ii. Summarized areas must be consistent throughout the FMP.

Explanations must be included for variance(s) between the current areas and any previously reported areas. If variances cannot be explained, a detailed account shall be provided as to why it was not possible to make a comparison. Changes in landbase classification are a significant matter and analyses of variance(s) from previous analyses are essential to evaluate the magnitude and impact of these changes.

4.0 Yield Projection Standards

These standards describe the requirements for developing and monitoring yield projections and regeneration standards for use in forest management. The landbase description cannot be completed before Alberta approves yield projections therefore the ToR must indicate the *agreement-in-principle* of these activities is concurrent. The technical requirements of yield projection are addressed first and monitoring requirements second.

Alberta's basic assumption is that reforestation performance directly affects projected yields in managed stands. Thus, each yield projection must have associated regeneration standards that serve as targets for silviculture programs.

The following objectives, definitions and principles apply:

Accurately predict yields for all managed stands.

i. Create valid and *accurate* yield projections for the major forest types comprising the net landbase.

   a. Types of stands – two types of stands shall be considered, natural and managed. Natural stands are those that have been established without human intervention through natural causes (e.g., wildfire, *insects and diseases*). Managed stands are those that result after some type of timber harvest.

   b. Two types of growth projection – basic (essential) and enhanced growth projections shall be considered. Enhanced projections (*enhanced forest management*) are defined as those resulting from thinning, fertilizing, tree improvement or drainage. All other forest management activities are basic and shall be categorized as essential growth projections.

ii. Create valid and *accurate* relationships between regeneration standards and growth projections (yield projections) used in the FMP so that all managed stands can be assigned to a yield projection representative of the predicted stand growth at the time of a performance survey (as described in the Alberta Regeneration Survey Manual [Survey Manual]), or, immediately after the first entry if some type of *partial cutting* or *understorey* protection was used to create the stand.[2]

   Alberta expects significant refinements of a limited number of growth models (i.e., Mixedwood Growth Model (MGM), Growth and Yield Projection System (GYPSY), and Tree and Stand Simulator (TASS). Monitoring mature intact and thinned natural stands to develop empirical yield projections will give way to monitoring managed regenerating stands with a strong reliance on modelling for growth projection.

iii. Monitor actual growth to guide adjustments to yield projections and regeneration standards in the future.

   The following *guidelines* apply:[3]

   a. The highest priority for *accurate* yield projections is for managed stands representing sites that are predominant in the net landbase.

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[2] See Appendix C.

[3] See interpretive bulletin Yield Projection Guidelines for details.

b. Yield strata shall be based on standardized criteria that can be applied to large regions of Alberta and which can be localized for each area. (See Interpretive Bulletin - Yield Projection Guidelines for Alberta for details)

c. Co-operative programs for managing and sharing data are encouraged to maximize efficiency in implementing the necessary activities.

Yield Projection Technical Standards

4.1 The yield strata used have been approved by Alberta.[4]

A standardized approach to yield strata is required for growth comparisons across administrative boundaries (FMA, FMU, defined forest area (DFA), SYU), cost-effectiveness and efficiency of monitoring programs, and to facilitate credible relationships between regeneration standards and growth and yield projections.

The yield projection approval shall document Alberta's *issues* with the yield projections that must be addressed by subsequent forecasting and monitoring activities. Alberta's objective is to obtain assurance that should yield projections prove to be inaccurate, risks to *desired future forest* values are addressed through monitoring mechanisms that result in timely and effective corrections.

4.2 The plan for developing yield projections has been approved by Alberta prior to implementation.

Growth and yield programs involve long-term commitments and relatively high expense. Clear planning at the beginning of program development will be rewarded with lower costs and higher value products. A clear and comprehensive plan is necessary for the efficient development of yield projections. The ToR must identify the schedule for acquiring Alberta's approval of this plan early in the process. The following standards provide a checklist for items to be addressed in the plan. The General Standards 1.0 listed in this annex apply and the Attribute Standards below shall be incorporated in developing the yield projections.

Attribute Standards

Yield Projections

4.2.1 Yield projections predict the average merchantable volume and average tree size by species, stratum and age-class.

i. Average merchantable volume per hectare at the *utilization* and merchantability standards prescribed in the *Forest Management Agreement*, and at any *utilization* or merchantability standard evaluated in the FMP and timber supply analysis for any stratum that may be subject to harvesting at such a standard.

ii. Average tree size by species represented as trees/m^3 or m^3/tree.

4.2.1.1 Development and review of yield projections has been completed using a data set approved by Alberta.

Yield projections may be developed based on permanent or temporary sample plots, or some combination of the two, plus associated data.

4.2.2 Natural Stand Projections

i. **The statistical relationships between the predicted (dependent) variables and inventory (independent) variables have been stated.**

Such variables may be categorical (e.g., AVI stand origin, TPR, species composition classes), in which case they must be consistent with the inventory and stratification scheme (see standard 2.1), and/or continuous (e.g., age, site index, stand density) in which case values used for *estimation* must be based on unbiased sample data.

4.2.3 Managed Stand Projections

i. **The statistical relationships between the predicted variables and variables to be used for measuring early crop performance (e.g., density, stocking, height) have been stated.**

4.2.4 Yield projections have been calibrated to local forest conditions.

i. **All yield projections used in a FMP have been calibrated to local conditions by using inventory data, reforestation results, and DFA-specific PSPs acceptable to Alberta.**

a. The *calibration* of yield projections for natural stands must be based on inventory data from within the DFA.

b. The yield projections must be consistent with the values observed in these strata for given levels of input variables (e.g., site index, density, basal area, age).

c. Managed stand yield projections must be supported with analysis of reforestation results and PSPs applicable to the DFA.

d. Yield projections shall require adjustment if the strata are subject to influences or risks not reflected in the data used for developing yield projections, such as *understorey* protection, or stands affected by *insects and diseases*.

4.2.5 Yield projections are relevant to VOITs in the FMP.

a. Yield projections must represent the strategies proposed in the management plan. Strategies such as enhanced post-harvest yields, enhanced yield on managed natural stands, uneven-aged management, and varying tree *utilization* standards, must have yield projections and regeneration standards that specifically predict the projected yields resulting from such activities. Techniques other than traditional volume/age empirical yield projection construction, such as guide curves, complex growth models, or two-step approaches, may be used.

b. Yield projections incorporate permanent productivity losses (e.g., maintaining a thinned stand condition for FireSmart or wildlife management objectives).

4.2.6 The modeling procedures evaluated and the rationale for selecting the yield projections have been described.

a. The methods used (e.g., multiple averaging, weighting, capping, arbitrary limit setting, using plots in multiple strata and removal of plots, or using a growth model) must be fully documented and explained.

b. Inventory stand descriptions and origins must be maintained throughout the yield projection development process.

4.2.7 The complete documentation required to support the proposed yield projections has been submitted.

The documentation requirements are:

a. Individual tree and plot compilation methods used. If the compilation methods are common, a reference shall be adequate.

b. All constants for all equations must be defined, including stump height and log length.

c. Taper functions applied (or equations used) to estimate individual tree volume must be documented. If new taper functions are developed using localized data, the procedure must be fully documented and technically sound.

d. The technique used to account for cull deductions. Cull deductions are applied to yield projections rather than in the form of reduction to the *harvest level* in the timber supply analysis. The method of application and the magnitude of reductions must be documented.

e. The methods used to assign yield plots to their respective yield class. This process must be identical to the one used to stratify the net landbase into the yield strata.

f. Inventory variables used to develop volume: age relationships.

g. The differences between the plot measurement date and inventory date. Plots must have a sample date within 5 years of the aerial photography interpretation used to generate the inventory label. If the age difference is greater, approval from Alberta is required before the plots are used.

h. The sampling intensity by yield strata. This must be quantified relative to the amount of area in the net landbase, and shall account for both the available plots, and the plots left after

subjective deletions. Tables must be provided that show the number of plots by heights and ages for each stratum. Plots shall be distributed in a reasonably representative fashion.

i. The details on the *utilization* standard used for both coniferous and deciduous species. Include which species are considered merchantable. Non-harvested species must not be used for yield projection. Status and use of dead trees and nil-tally plots must also be described.

j. The mathematical formulation of the models used during yield projection development. The corresponding table of coefficients must also be included. Statistics generated that demonstrate the validity of the relationships used in curve fitting must be reported. If a guide curve (e.g., indicator variable) approach was used, it must be made clear which specific data were grouped together to develop the guide curve. How death age is derived must also be described.

k. The set of post-modelling *assumptions* and modifications applied to the yield projections, if any. These adjustments must have been made prior to submitting the projection. The unaltered projections must also be included. All rules, *constraints*, or adjustments used in the timber supply analysis (TSA), which influence the yield projection shall be submitted to Alberta. Examples include death ages, target harvest age, *growing stock* adjustments, and selection of stands (oldest first vs. optimization).

l. Volume tables and graphs of yield projections are provided in both hard copy and digital format specified by Alberta.

m. The natural and managed yield projections. Submit both projections as produced by the basic yield model selected, and the corresponding final yield tables that will be used in the TSA if these are different, to account for any adjustments or *assumptions* applied in the TSA.

n. The plot volumes plotted against each of the yield projections. The average volumes by age-class must be included. The selection of the age-class interval is a matter of choice; however narrow age-classes have a tendency to obscure trends in volume by age. Age-classes of 20 years are recommended. When plotting the final yield projections, plot the data points by 20-year age-classes.

o. Area weighted composite yield projections for the total productive forest landbase contributing to the proposed *harvest level(s)*. These shall be done by cover group or closest proxy seen in the Organization's selected yield strata. These projections also must include the area-weighted average values by age-class, as above. In the case of natural stands, coniferous/deciduous composition must be stratified at least to the broad cover group level of C, CD, DC and D. A composite yield forecast for natural stands resulting from application of the local natural stand yield tables must be reconciled with inventory estimates specific to the sustained-yield unit on which the timber supply is to be calculated.

p. The amount of area per yield stratum in the net landbase, along with the number of samples used to develop the age:volume relationship. The samples are balanced with respect to the current inventory. Both percentages and actual numbers must be provided.

Models

4.2.8 The stand model or analytical system (referred to as "model" hereafter) used to generate yield projections has been approved by Alberta.

Alberta's requirements for models used to develop yield projections are:

i. The biological *assumptions* and mathematical relationships used shall be explicit and made available to Alberta. Both a hard copy and a digital copy of pertinent program codes (i.e., actual code segments listing the coefficients and functions) must be provided for all data compilations, stratification and curve fitting. Any computer program code must be annotated to allow for ease of review.

ii. The structure of the model shall be biologically realistic and consistent with established theories of stand growth and yield.

iii. Statistical properties and error shall be evaluated and known.

iv. Sensitivity, bias, and precision of the model and its components shall have been tested with independent data sets.

v. Predictions shall be reasonable and within the ranges of parameter variation observed in the data used for model development and local *validation*.

vi. Predictions of absolute productivity for natural stand yield projections must be consistent with unbiased mean values from the defined yield strata.

vii. Model forecasts must be evaluated using available real growth data at intervals not exceeding 10 years.

viii. Models shall have undergone independent peer review.

Data

4.2.8.1 Data used for yield *verification* have been approved by Alberta.

The data used for model development (not local *calibration* of *yield projections*) do not have to come from Alberta forests. Models or model components predicting treatment response may be drawn from a wide range of sources for the species in question providing the site, stand and treatment parameters can be related to Alberta conditions.

a. Predictions of absolute productivity must be based on observations within the established Alberta vegetation and ecological stratification.

b. Temporary (TSP, single-examination) or permanent (PSP, re-measured) sample plots may be used for model development and local *calibration*. Real (direct) growth data from *permanent sample plots* are preferred for *validation*.

4.2.8.2 The volume sampling design has been approved by Alberta and fieldwork did not commence prior to this approval.

The design must include the following:

a. The sample design used must demonstrate that the sample provides an unbiased representation of forest types present in the net landbase. Stand selection and plot location procedures must ensure that commonly recognized principles for a statistically valid sample design are followed.

b. Quality control procedures.

c. A description of any additional data or information collected, including how it may be used.

d. The sample design must provide a representative sample of the net landbase. The plots must be allocated in an unbiased random or a systematic (grid) basis.

e. Plots must be 100 m^2 or larger in size.

f. If multiple plots are established from a single location (e.g., as a transect across a polygon), the plots must be established in a manner that minimizes bias in the sample.

g. If plots are moved from their original, planned location (e.g., to avoid seismic lines) a description of the procedures followed to relocate the plots must be provided. Procedures for dealing with nil tally plots must also be described.

h. Plots originally established for operational timber cruising must not be used as inventory volume sampling plots without Alberta's approval. Where Organizations propose to use such plots for inventory volume table or yield projection development, a copy of the original plot data in both digital and hard copy along with the original tally sheets must be provided to enable Alberta to carry out the assessment.

4.2.8.3 Volume sampling data sets have been submitted in a format acceptable to Alberta.

Required data includes:

a. Raw, uncompiled sample tree and plot data.

b. Any intermediate analysis

c. Complete AVI attributes attached to the full plot header.

d. Individual tree compilations.

e. Plot-level and stratum-level compilations.

f. Co-efficient files, as well all other external files needed to duplicate the submitted analysis.

g. A data dictionary.

4.2.8.4 An explanation of the methodologies used to construct all pertinent relationships accompanies the data.

Methodologies must clearly state whether the data used originated from within the area or from outside it. Spatial information must be provided that shows the location and distribution of sample plots.

4.2.8.5 Deletions from the gross landbase have been removed from the yield data.

a. The data used to localize the yield projections must be collected from sites in the net landbase. If the sampling scheme was applied without stratification to gross areas including riparian buffers or other management deletions, it shall be necessary to either post-stratify the data, or demonstrate that statistically significant differences do not exist between the mean attribute values for samples falling in the portions of each stratum which are defined as operable and non-operable.

b. The complete set of AVI attributes must be attached to the plot data. All deletions from the available data, including subjective deletions and unlinked plots, must be reported and explained in detail.

c. Documentation must be sufficient to enable Alberta to replicate and verify all calculations and the following characteristics of the resulting yield projections: site class, density class, origin, stand type, age and other criteria relevant to the FMP.

Yield Projection and Reforestation Monitoring Standards

Effective monitoring programs provide credible feedback on yield projections and the success of reforestation treatments. The analysis of this information is essential to enable the evolution of valid and *accurate yield projections* and the development of cost effective silvicultural prescriptions.

4.2.9 Monitoring systems approved by Alberta have been scheduled to be implemented.

Monitoring must:

i. Assure Alberta that stand treatments proposed in the management plan have been completed;

ii. Assess early performance so that harvested areas can be assigned to an appropriate yield projection; and

iii. Measure actual growth on both natural and managed stands to adjust yield projections.

4.2.10 A mechanism is in place to ensure that treatments approved in the FMP are implemented.

Alberta shall act to ensure that treatments proposed in the FMP according to the spatial harvest sequence and preferred scenario AAC are carried out.

4.2.10.1 RFP validated Alberta Regeneration Information System (ARIS) submissions accurately report all treatments.

4.2.11 All clearcut harvest areas, and partial cut[4] harvest areas (following the first harvest entry) have been assigned to a yield projection based on the results of an objective assessment survey approved by Alberta. (see standard 3.11 of this Annex)

Alberta shall make AAC adjustments following the completion of reforestation surveys on harvested areas. The AAC for the tenure-holder responsible for the reforestation shall be adjusted to reflect the actual results of reforestation. Regeneration performance results shall be used to adjust reforestation transition projections in each new FMP. (See Appendix A standard 2.3.2)

4.2.12 A permanent sample plot program, comprising a sufficient number of sample plots established to a standard approved by Alberta for each natural and managed strata yield projection used in the FMP, has been implemented.

i. The PSPs shall be re-measured on a schedule that allows the data to be used to refine strata yield projections in each successive management plan.

[4] See Appendix C.

ii. At each FMP revision (10-year intervals) the results of the PSP program shall be incorporated into both natural and managed yield projections and the projections shall be adjusted accordingly.

4.2.13 Actual delivered volumes, versus volumes anticipated by yield projections from harvested areas has been reported and includes the statistical significance of all variances.
It is essential to collect and analyze this information and use it in conjunction with the PSP data to adjust yield projections. This information is to be reported annually in the *annual operating plan (AOP)*, accompanied by an analysis of the significance of the results to date. This information is to be addressed in any review and/or revision of yield projections.

4.3 Reforestation Performance Standards

The Survey Manual establishes provincial reforestation performance standards (provincial survey standard) which are intended to create fully stocked natural stand yields. These standards shall be used until alternative regeneration performance standards are developed that are related to each yield projection used in a FMP. An interpretive bulletin on Alternative Regeneration Standards (ARS) will provide additional detail.

4.3.1 A mechanism is in place to develop alternative regeneration performance standards[5] acceptable to Alberta, which maintain the coniferous and deciduous LRSYA on managed essential stands at a level equal to or greater than that projected using the current Survey Manual standards.
The Survey Manual defines provincial regeneration standards that are the basis for the projected growth rate for the forest area (LRSYA[6]) and subsequent timber supplies. Alberta shall not approve *alternative regeneration standards* that will, in Alberta's opinion, result in a lower LRSYA for managed essential stands than that expected by applying the provincial survey standard.

4.3.2 *Alternative regeneration standards* include the key parameters for each stratum.
The key parameters are:

a. **Stocking** – a measure of spatial distribution of trees as per standards established in the Survey Manual.
b. **Density by species** – including total and crop tree density, and a density range (specify a maximum and minimum value for each stratum).
c. **Height by species** – including as a minimum, crop tree height (specify a minimum and maximum value for each stratum) and other height measures such as average, site height, top height as used in yield projections.
d. **Free-to-grow** – a measure of crop tree growth condition, growing space, and maximum levels of competing vegetation to obtain predicted yields.
e. **Other pertinent parameters used in the stand growth model** – for example, specific regeneration lag *assumptions*, years to breast height, and height to diameter ratios.

The standards shall take the form of a range of values for each key parameter that would justify assignment to a yield projection. For example, to be assigned to a medium pine site in the lower foothills region, a stand might need to have 5,000 to 8,000 stems per hectare, with an average height between 2 m and 5 m, and be free-to-grow at age 15. The intent is to accurately differentiate yield stratum for harvested areas based on measured tree and/or regenerating stand characteristics.

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[5] *Alternative regeneration standards*

[6] LRSYA $= \sum_{i=1}^{n} x_i a_i$, where x_i = maximum MAI of each yield projection, and a_i = the area of stands assigned to each yield projection.

4.3.3 Survey procedures and timing comply with the Survey Manual.
Alberta may consider alternate survey procedures if they provide the same level of data accuracy, spatial resolution, and consistency as produced using the procedures in the Survey Manual. The alternate procedure must be auditable. Surveys must report on all key parameters (e.g., height, stocking) to levels of accuracy demonstrated to be, in Alberta's opinion, similar to what would be achieved from the ground-based grid survey system described in the Survey Manual. Proposals based on aerial photography augmented with ground samples will be considered. Proposals based on visual estimates of the key parameters that cannot be audited will not. The alternative survey proposal must include a detailed analysis that demonstrates how the proposed survey system estimates the standard's variables relative to the ground-based grid survey system found in the Survey Manual. Partial harvesting regimes, depending on their nature, may require, one or more surveys.

4.3.4 *Alternative regeneration standards* describe a process for amalgamating FMP strata into the 10 provincial base strata.
It is recognized that FMP yield strata will be more extensive than provincial strata, and that the definition of "Satisfactorily Re-stocked" may vary by FMP and *alternative regeneration standards*. However, Alberta prepares provincial reports on reforestation performance for these base strata, for stewardship reporting and department business plan requirements.

4.3.5 *Alternative regeneration standards* survey data has been reported to ARIS according to requirements in the *ARIS Industry Operations Manual.*
Additional reporting may be required outside of ARIS (e.g., 5 year FMP stewardship report) depending on the specific proposal and additional variables used in FMP growth predictions and associated measurement of regeneration performance (see standard 4.3.2e, above).

4.3.6 The strata balancing directive has been followed.
See Appendix A standard 2.3.2 in this annex, for more details on AAC adjustment based on regeneration survey results.

4.3.7 *Alternative regeneration standards* have been developed using applicable research, information from past treatments, pertinent growth models, raw plot data from regeneration surveys, PSP information and additional studies from managed stands, and all data used to develop the standards have been provided to Alberta.

4.3.8 Written agreement with the proposed *alternative regeneration standards* from all affected *timber disposition holders* has been provided for DFAs with overlapping timber dispositions. If agreement is lacking, a written statement of concerns from those not in agreement has been provided.

4.3.9 *Alternative regeneration standards* have been approved by the Executive Director, Forest Management Branch prior to their implementation.

5.0 Forecasting Standards

Forecasting is the analysis of a range of realistic forest management scenarios, and the selection of the preferred scenario representing the optimum result. The assumptions and output of the preferred scenario dictate the forest management activities that shall be used in implementing the plan.

The key outputs of the preferred scenario are:

i. timber harvest levels (recommended AAC)
ii. *spatial (mapped) harvest sequence* showing the stands scheduled for harvest in the first 20 years of the *planning horizon*.

An initial description of appropriate administrative boundaries (e.g., DFA, FMU, SYU, landscape units,) shall have been defined in the ToR. Forecasting may require these units be modified to attain acceptable results in the preferred scenario.

The scenarios evaluated in forecasting may affect the landbase description and yield projection phases, which may have to be modified to enable effective forecasting that adequately characterizes the results of various strategies.

5.1 The TSA for the preferred forest management scenario generates maps showing the future forest condition at appropriate strategic and operational scales.

5.2 All data sets used in the landbase classification process have been approved by Alberta for use in the Timber Supply Analysis.

The Organization must demonstrate they have maintained on-going dialogue with Alberta to ensure the data sets used for forecasts meet Alberta's requirements.

5.3 The model(s) used in forecasting, the landbase description, and the yield projections used for the forecasts, have been approved by Alberta.

The following information must be provided for model(s):

i. Model name
ii. Version number
iii. Creator
iv. Model type (e.g., simulation, optimization)
v. Description of model capabilities
vi. Description of history of the model and its use in Alberta and/or Canada

Alberta shall approve models that it deems to have the ability to evaluate the proposed management strategies.

5.4 A complete digital copy of the model formulation and a description of the process used to create the input files for each forecast is available to Alberta on request.

Alberta may request digital copies of the query protocols used to create the model input file(s) and/or the protocols that link the final classified landbase attribute (GIS) file to the timber supply analysis model.

i. Digital files containing the model input files used in the analysis of the preferred scenario and any supporting sensitivity analyses must be provided.

5.5 The submission includes a detailed explanation of the decision-making process used to select the preferred scenario.

i. The forecasts used to derive the preferred scenario must use the classified landbase and yield projections that have received Alberta's *agreement-in-principle*.
ii. A summary of the various alternatives tested leading to selection of the preferred scenario must be provided, including a rationale for the various technical protocols that were evaluated and changed between runs.

Forecasting effort must be focused on evaluating complete scenarios that are practical and reasonable. This complex process is often very confusing to participants and as result, decision-making can be difficult. There will be many preliminary forecasts completed to assess various management options which must be documented and archived; however, only the preferred scenario shall be submitted with full documentation, and a summary discussion of the next two or three most likely possible scenarios. *Due diligence* requires that all practical and reasonable scenarios be evaluated in the process used to select the preferred scenario and that these forecasts be comprehensively evaluated with other participants in the planning process. All data on scenarios must be retained and available to Alberta on request, but need not be submitted automatically.

5.6 The submission includes a description of the forecasts completed (see standard 5.4) and the rationale used in the review and analysis of each scenario.

i. **Projected forest structure is generally acceptable to Alberta.** – To evaluate this criterion, the following points must be addressed:
   a. *Compartment* sequence and *spatial harvest sequence* in each *compartment* (see standard 5.7)
   b. Road corridors necessary to implement the harvest sequence
   c. Habitat requirements for species of special management concern.
   d. Age-class, opening size and cover type distribution
   e. Wildfire threat

ii. **Projected timber supplies are acceptable.** – To evaluate this criterion, the following points must be considered:
   a. Volumes projected.
   b. Tree size, silviculture, and haul distance are reasonably stable throughout the *planning horizon*.

iii. **Sensitivity of long-term forecasts to yield projections**
If Alberta has concerns about yield projections being used, Alberta shall prescribe projections to be used in *sensitivity analyses* and select appropriate yield projections using this analysis. The risk analysis shall compare the resulting 20 year *harvest level* against Alberta's yield projections for the duration of the *planning horizon*. In the case of optimistic yields, if the long-term average wood supply is less than 90% of that projected using Alberta's more conservative projected yields for the entire *planning horizon*, the optimistic yields will not be acceptable and new yield projections shall be developed.

iv. **Sensitivity of long-term forecasts to accelerated harvests**
Accelerated timber harvesting is an acceptable forest management approach (e.g., mitigate wildfire risk or *forest health issues*, age-class imbalance, address timber production and quadrant/period balancing). The impact on long-term forecasts shall be calculated. Accelerated harvesting strategies may be approved that vary from the listed conditions provided Alberta determines the rationale to be sound, supporting documentation valid, and risk acceptable.
Conditions for an accelerated harvest are,
   a. Occurs over the first 20 years of the *planning horizon*, and
   b. Recommended *harvest level* does not exceed 125% of the unaccelerated average even-flow *harvest level*, and
   a. The average even-flow *harvest level* for the remaining 180 years is not less than 90% of the unaccelerated average even-flow harvest flow for the entire *planning horizon*.

v. ***Evaluation* of *enhanced forest management* strategies and calculation of AAC changes.**
The allowable cut effect (ACE) attributable to a particular *enhanced forest management* strategy shall be computed by repeating the forest-level timber supply analysis, with and without enhanced stand growth and yield assumptions. In this discussion, "non-enhanced sustainable timber supply" refers to the sustainable level of harvest without assumption of enhanced stand growth and yield. "Enhanced sustainable timber supply" refers to the level of harvest that is sustainable with enhanced stand growth and yield. Risk shall be evaluated as described for yield projection and accelerated harvest strategies. ACE shall be approved only for activities that are scheduled to commence operationally in the first 5-year period of the planning horizon.

5.6.1 The reasons for any changes in the timber supply between the preferred scenario and the existing approved timber supply has been explained in the documentation.
The explanation shall focus on the changes resulting from changes in the net landbase, changes in yield assumptions, and changes in management strategies.

5.6.2 Information required on the preferred scenario has been submitted to Alberta.

Alberta shall provide more detailed instructions when the information is being prepared for submission.

Alberta requires a description of the current and projected *desired future forest* condition.

i. The data shall be submitted in a digital flat-file.

ii. Information must include the total DFA area and cover the entire *planning horizon*. (See standards 5.10 and 5.11)

5.7 The *Spatial Harvest Sequence (SHS)* has been selected considering key *issues*.

The following key *issues* shall be considered in selecting the SHS:

i. The timber operator(s) agree on which operator will be harvesting which stands identified in the SHS. The agreement must be in sufficient detail to be applicable at the time of operations.

ii. Agreement on stands with inventory-identified *understorey* is required.

iii. The scheduling of operations in various compartments is acceptable. The location and scheduling of forest management activities may be a useful tactic for meeting other resource needs.

iv. The distribution and arrangement of stands to be harvested is acceptable. The objective is to select a SHS that optimally addresses the following *issues*:

a. Protection of *watershed* and riparian values.

b. Maintenance of effective habitat for species of special concern.

c. Meet *visual quality objectives*.

d. Feasibility of efficient forest management operations.

e. *Desired future forest* structure.

f. Acceptability of fire threat.

g. *Insects and diseases*.

h. Intensive energy sector developments (e.g. mining, *SAGD*, heavy oil)

5.8 Mandatory assumptions have been applied in the preferred scenario.

Unless otherwise approved by Alberta, mandatory assumptions shall be applied. The mandatory assumptions are:

A. Fundamental Even Flow Scenario Assumptions

i. The *planning horizon* is 200 years.

ii. Even-flow timber supply for the *planning horizon* - the maximum allowable tolerance in the periodic harvest is +/-5% of the *planning horizon* average.

iii. The amount of operable *growing stock* must be stable over the last quarter of the *planning horizon*.

iv. The total coniferous and total deciduous volumes must be projected.

B. Uneven Flow Scenario Assumptions

Alternate assumptions may be approved if, in Alberta's opinion, the result is a more acceptable future condition. Assumptions A (i), (iii), (iv) apply but the flow constraint may be modified as follows:

i. Prevalence of older age-classes

An accelerated harvest may be needed to avoid future losses to *insects and diseases* or fire. The accelerated rate of harvesting adopted for the short term cannot cause the long-term *harvest level* to increase to more than 125% of the unaccelerated *harvest level*, and, decrease to less than 90% of the unaccelerated *harvest level*, or the long-term basic productivity level (LRSYA, *maximum mean annual increment* X net landbase), whichever is greater.

ii. Immature Forests

Where the forest is basically immature, a non-declining volume supply profile shall be adopted. Under non-declining flows the *harvest level* is initially low but increases when greater proportions of the immature *growing stock* reach merchantable sizes and volumes. The *harvest level* will increase over time to a point where generally equal volumes of timber may be harvested annually.

5.9 The submission includes documentation explaining each managed assumption in the preferred scenario.

Managed assumptions represent management decisions or activities for which there are a range of options that can have a significant impact on the preferred scenario. The rationale for each managed assumption must be explained and the following managed assumptions must be addressed at minimum.

5.9.1 Strata transitions (i.e., changes in yield stratum after an area is harvested) have been supported with evidence from performance analyses of past silvicultural treatments. The submission includes firm commitments to conduct the silviculture treatments necessary to provide sufficient assurance that the transitions proposed are practical and reasonable.

A forecast must be completed assuming natural to natural transitions to generate the baseline long run sustained yield average (LRSYA).

5.9.2 Silviculture regimes have been developed for all FMP strata.

Generalized silviculture regimes (a listing of time-specific silviculture interventions) shall be developed for all recognized FMP strata outlining how key site limiting factors will be addressed in order that the desired future stand conditions are likely to be achieved. Such regimes will be based on regeneration models and requirements described in Appendix C - Reforestation Strategies. The silviculture regimes approved in the FMP will be followed in silviculture operations, unless otherwise approved in the AOP.

5.9.3 Landbase assignments for coniferous and deciduous timber have been established.

Landbase assignments are a significant *issue* for operators, reforestation, and spatial harvest sequencing. It is essential to complete this task to ensure the FMP can be implemented. Regardless of the landbase assignments, strategies are required that will replace all of the deciduous and coniferous volumes harvested. A practical and *accurate* cut control system must be included. In the event that the AAC includes both primary and secondary volumes, the cut control system must ensure that the areas contributing to primary volumes are not over-harvested in any *cut control period*.

5.9.4 Coniferous *understorey* management is based on data acceptable to Alberta.

Stands with coniferous understories require special consideration[7].

Proposed *understorey* protection harvests on coniferous landbase must have transitions and yields projected in the TSA based on data acceptable to Alberta.

5.9.5 Green-up *constraints* acceptable to Alberta have been applied.

The green-up period is the time during which harvesting of adjacent areas is not permitted.

i. The default *green-up periods* for Alberta harvested areas are 20 years for coniferous and 10 years for deciduous.

   The green-up *constraints* may be altered as long as the result is acceptable. The minimum criteria for acceptability of alternate strategies are:

   a. The opening size predicted for the first two 20-year periods falls within the natural range of variability (NRV). Analyses of the forest cover inventory in the area will provide guidance regarding acceptable opening sizes, and,
   b. The distribution of proposed harvesting is generally acceptable to stakeholders, or,
   c. A biodiversity analysis acceptable to Alberta has been completed.

5.9.6 Allowances for natural disturbance events have been addressed.

i. Describe how losses from fire and/or *insects and diseases* are addressed.
ii. Burned areas shall be deleted from the net landbase unless the Organization commits to reforest the areas, or an approved forest cover inventory shows that acceptable forest cover has been re-established.

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[7] See Appendix C

5.9.7 A process, acceptable to Alberta, has been developed to account for, accurately report and allocate total timber depletion on the DFA.

i. All future timber losses due to other land uses (e.g., energy and grazing) shall be assessed and treated as production in cut control management.

ii. Strategies for minimizing these losses and measuring timber volume depletion shall be identified.

iii. Historical timber losses from other land use activities shall be captured in the current net landbase for the FMP.

5.9.8 A strategic plan for forest management access throughout the DFA is completed.

The access required for forest management is a significant and complex *issue* that shall be addressed in the FMP.

5.9.8.1 A proposed road corridor plan describing the permanent road network needed to access the total net landbase and implement the spatial harvest design has been completed.

This plan outlines the most probable locations for road corridors that will enable access to each subunit on the FMA for forestry purposes. The level of detail required is that of a Phase I road corridor plan. Access management for purposes other than forestry will be directed and determined from other government planning initiatives.

5.9.8.2 All forestry access limitations have been considered and explained.

i. Explain compartment sequencing or *constraints* on areas that are inaccessible for a period of time.

5.9.9 Productivity losses from road, decking and processing areas on reforested areas have been applied.

i. A 5% reduction in reforested area following harvest shall be incorporated into the TSA to account for losses from unsuccessfully reclaimed temporary roads, decking and processing areas. Organizations may minimize this reduction through analysis of survey data on actual losses in each FMP.

5.9.10 Timber operability and economic limitations have been reported.

i. At minimum, piece size (trees/m^3) must be predicted for the entire *planning horizon* to ensure that precipitous declines in the future are avoided.

ii. A minimum harvest age shall be established for each yield stratum that reflects the operability limits and piece size.

5.9.11 Strategies to address biodiversity and species of special management concern have been established.

The maintenance of forest conditions within the range of natural variability (NRV) is the primary mechanism to be employed. To be successful, strategies to achieve this are established in the FMP. Annex 4 contains the values, objectives, indicators and targets to be incorporated at minimum.

i. Retaining significant stand structure characteristics in harvested areas is essential to maintaining ecosystem functions. The objective is to leave sufficient structure with minimum impact on timber supplies. It is anticipated that as understanding of this *issue* increases the strategies and tactics will continually improve.

ii. Merchantable volumes that are permanently retained to create stand structure shall be measured and treated as production in cut control management.

iii. The plan for implementing, monitoring and reporting on structure retention must be included in the FMP.

iv. Habitat requirements and access management strategies to address species of special concern have been addressed.

5.9.12 Strategies to address forest protection *issues* have been established.

Annex 3 contains the requirements for addressing fire protection. Strategies to address *insect and disease issues* shall be developed as necessary.

5.9.13 Predictions for water yield and strategies to manage riparian *issues* have been established.

The impacts on water yield must be predicted. *Watershed* modelling and analysis will determine an acceptable target for water yield increase following harvesting for third order watercourses. The ToR will describe the models to be used and assessments to be completed.

a. Where changes in operating ground rule *watercourse buffers* are proposed, the rationale and projected results must demonstrate that the future forest landscape is significantly enhanced over that which is created by current standards and is acceptable to Alberta.

5.9.14 Visual quality strategies have been established.

i. Strategies to address visual quality must be identified and implemented. A *visual resource inventory* and objectives shall be addressed.

5.9.15 The requirements of the *Standards for Tree Improvement in Alberta* have been addressed.

If the preferred scenario includes enhanced stand growth and yield due to tree improvement activities, the organization must describe how the requirements of the *Standards for Tree Improvement in Alberta (STIA)* have been addressed, with particular emphasis on STIA standards 18.4 (controlled parentage), 31.0 (genetic gain analysis), 25 (non-adapted materials and associated research), and 20 (conservation areas).

5.9.16 Grazing interests have been addressed.

Objectives and strategies to integrate grazing interests are developed and are reflected in the FMP spatial harvest sequence for Forest Management Areas and Forest Management Units with grazing dispositions. If available, Regional Grazing Plans will be used to incorporate grazing interests and may be modified as required to address the proposed timber harvest sequence and cutblocks.

Future Forest Condition

5.10 A data set (file) has been provided containing the post-harvest forest condition for the preferred forest management scenario, for 0, 10, 20 and 50 years for each FMU and/or sustained yield unit.

The data set shall depict:

- Compartment
- Yield strata
- Age class
- Contributing land base area
- Non-contributing land base area
- Coniferous *growing stock*
- Deciduous *growing stock*
- Other data to describe outputs for values, objectives, indicators and targets

Harvest Schedule (i.e., definitive stand list)

5.11 A data set (file) has been provided containing the harvest schedule for 70 years for the preferred forest management scenario, for each FMU and/or sustained yield unit, compartment and period.

The data set shall report:

- Area harvested by yield strata, age class, harvest activity (harvest/treatment regime), reforestation transition and management intensity (basic/enhanced)
- Coniferous and deciduous volume harvested (primary and secondary)
- Coniferous and deciduous piece size
- Spatial schedule of stands selected for harvest

5.12 Table 1 has been completed for all forest operators and included in the FMP.

Table 1
Timber Allocations

Historical Allocation

Company Name	Disposition Number	FMU	Landbase management Type	Effective Date of AAC	Deciduous AAC (%)	Deciduous AAC (m^3/yr)	Incidental Deciduous (%)	Incidental Deciduous (m^3/yr)	Coniferous AAC (%)	Coniferous AAC (m^3/yr)	Incidental Coniferous (%)	Incidental Coniferous (m^3/yr)

Proposed Allocation

Company Name	Disposition Number	FMU	Landbase Management Type	Effective Date of AAC	Deciduous AAC (%)	Deciduous AAC (m^3/yr)	Incidental Deciduous (%)	Incidental Deciduous (m^3/yr)	Coniferous AAC (%)	Coniferous AAC (m^3/yr)	Incidental Coniferous (%)	Incidental Coniferous (m^3/yr)

Utilization

Utilization used to determine Harvest Level in PFMS					Operational Utilization						Marginal Dues Utilization			
Disposition Number	Top Diameter (cm)	Butt Diameter (cm)	Minimum Length (m)	Stump Height (cm)	Top Diameter (cm)	Butt Diameter (cm)	Minimum Length (m)	Stump Height (cm)	Deciduous AAC (m^3) based on operational utilization	Coniferous AAC (m^3) based on operational utilization	Top Diameter (cm)	Butt Diameter (cm)	Minimum Length (m)	Stump Height (cm)

Production

Disposition Number	Cut Control Period	Periodic Cut Control AAC (m^3)	Quadrant Date	Previous Quadrant Production (m^3)	Quadrant Coniferous Under-production (m^3)	Quadrant Deciduous Under-production (m^3)	Quadrant AAC (m^3)

Chargeability

Disposition Number	Deciduous Species Used in AAC	Coniferous Species Used in AAC	Species NOT Chargeable to AAC	Rights to Species NOT Chargeable to AAC	Structure Retention (%)	Structure Retention (%) Accounted for in AAC	Net landbase Variations (net landbase not included in AAC, by covertype or by species)	Net Landbase Variation: Rights to Timber	Industrial Salvage Accounted for in AAC

Fiber Assignment Agreements

Assignment Type (e.g., FMA, DTA, VSA, CTQ)	Directed To (Company name)	Disposition Number	Species (Coniferous or Deciduous)	Volume (m^3)

1

The SHS is the most important output of the scenario forecasts as it implements the strategy the Organization(s) must follow to achieve the predicted future forest condition. The future forest condition, while dependent on many factors, is strongly influenced by harvest patterns, intensity and schedules. It presents spatially and temporally how the integration of environmental, economic and social values will be achieved on the DFA. Adherence to the planned harvest sequence is imperative to achieving the predicted future forest.

6.1 A mapped *spatial harvest sequence* (hard copy and data file) showing the inventory cover types scheduled for harvest in the first two 10-year periods of the *planning horizon* has been submitted.

It is necessary to follow the SHS approved in the FMP to be reasonably confident that the *desired future forest* condition shall be created. Spatial referencing in the timber supply analysis is necessary to facilitate monitoring and equitable implementation of the management plan. The management plan approval shall approve implementation of the SHS. If at the time of operational planning Alberta agrees there are factors that affect implementation of the SHS, operational plans shall be developed based on the SDT.

6.2 A Strata Description Table (SDT) describing the areas in each compartment of the age-classes in each yield strata scheduled for harvest in the first two 10-year periods of the *planning horizon* has been submitted. (See standard 5.6.2)

6.3 The SHS reflects the net landbase strata profile.

6.4 The *spatial harvest sequence* has been developed to comply with the planning and operational implementation conditions.

The planning and operational implementation conditions are:

The *harvest area* (ha) shall not exceed 100% of the total area (ha) in the approved SHS/SDT by compartment per decade without a management review. During forecasting, the SHS has been evaluated and it is confirmed[8] the SHS can be converted to a Final Harvest Plan (FHP) (see *Timber Harvest Planning and Operating Ground Rules*) by deleting less than 20% of the total area (ha) by compartment per decade. For operational flexibility, the area (ha) deleted from the SHS may be replaced with an equivalent area (ha) of stands from the net landbase.

i. The SHS shall incorporate any harvest areas that are planned or approved in operating plans at the time of the effective date for the inventory.

ii. The second decade of stands identified in the SHS are included in this plan to facilitate the transition to the next FMP. These stands shall be reviewed during the development of the next FMP, due at the end of the first decade.

iii. Alternative SHS implementation protocols, as follows, may be acceptable to Alberta.
The *harvest area* (ha) shall not exceed 110% of the total area (ha) in the approved SHS/SDT by compartment per decade without a management review. During forecasting, the SHS has been evaluated and it is confirmed[9] the SHS can be converted to a FHP. For operational flexibility, stands may be deleted (as above) from the SHS and replaced with an equivalent area (ha) of stands from the net landbase within the following limits.

a. The *harvest area* (ha) must not exceed 110% of the approved SHS/SDT area (ha) by yield stratum and compartment, and shall not exceed 100% of the yield stratum area (ha) by decade unless otherwise approved by Alberta. (i.e. no single stratum *harvest area* shall exceed 100%)

b. i and ii above.

6.5 Variances from the SHS and SDT have been totalled and reported for all operational plans addressed in the current FMP at the time of operational planning (i.e., preparing the harvest design for an area as per the *Timber Harvest Planning and Operating Ground Rules*),

i. Variances shall be identified as additions or deletions. Deletions are either permanent deletions from the net landbase or deferrals to a later time, and are organized as follows:

a. Operational changes in *harvest area* due to:

1. Covertype boundary changes for operational efficiency.

[8, 9] *Evaluation* and confirmation of SHS is completed using aerial photography and field reconnaissance.

2. Additional buffers or deletions required that were not deleted from the net landbase (e.g., historical sites, wildlife sites, additional stream buffers, steep slopes, unstable areas, land use).

b. Inventory

Changes in the *harvest area* due to:

1. Inaccuracies in cover typing, (i.e., incorrect leading species, non-edge-tied map sheets).
2. Errors in net landbase determination (e.g., private lands not deleted, existence of understorey not included in the covertype classification).
    a. Variances from the SHS resulting from *understorey* management[10] shall be classified as inventory errors. Alberta shall require that the inventory be updated very quickly to address such errors.
3. Covertypes deleted or deferred for economic reasons.

6.6 Reported variances from the SHS/SDT have been used to modify the timber supply analysis.

If future variances are deemed significant by Alberta, the variances may be used to direct immediate changes to the timber supply. As a general guide, the following variances are Alberta's primary concern:

i. Avoidance (deletion or deferral) of harvest on poor quality covertypes in the harvest sequence. Alberta's response shall be to remove these types from the net landbase and immediately reduce the AAC if they are not being harvested.

ii. Operational deletions not addressed in the net landbase. Alberta's response shall be to ensure that operational deletions are accurately addressed in the net landbase for use at either the stewardship report review or when the FMP is revised.

iii. Inventory changes that result in changes to the landbase/operator designation. Alberta's response shall be to ensure the operational deletions are accurately addressed in the net landbase for use at either the stewardship report review or when the FMP is revised.

iv. *Variance* shall be treated as follows in operational planning:
    a. If the *variance* is less than 20% on a harvest design (FHP) that was validated by a RFP, Alberta shall expedite the approval and comment on any concerns arising from a review of the *variance*.
    b. Such comments must be addressed in preparing the stewardship report or next management plan. If Alberta decides that variances described above are significant, the AACs shall be adjusted immediately.

v. If the *variance* exceeds 20%, Alberta shall conduct a *full review* of the design prior to approval. If variances are found to be significant by Alberta, the AACs shall be adjusted immediately.

In the event of major change in circumstances in a compartment (e.g., wildfire or *insect and disease issues*, major change in land use direction) the SHS/SDT shall be abandoned and a new strategy developed.

[10] See Appendix C

Appendix A - Implementation of New Annual Allowable Cuts Standard

GENERAL

Annual allowable cut (AAC) is the volume or area of timber that may be harvested annually from a *forest management unit (FMU)*, as established by the Minister.

The Minister has the right to change the *annual allowable cut* of an FMU and the corresponding authorized FMA, *Quota* and DTA volumes at any time when, in his opinion, it is in the *interests* of good forest management.

1.0 Rules

The following principles and rules shall be used in allocating revised AACs:

i. The *annual allowable cut* for an FMU shall normally be re-assessed every 10 years but may change in the interim if Alberta believes there is sufficient reason. In either event, changes in AAC shall be effective at the beginning of the timber year in which the AAC is approved.
ii. When FMUs are consolidated, the new FMU commencement date shall coincide with the effective date for the revised AAC.
iii. In the event that FMUs or allocations are merged, the new allocation shall be the sum of the previous allocations unless otherwise agreed to by all parties affected and approved by Alberta.
iv. When an AAC is revised irrespective of the reason, the volume available in the *cut control period* shall be the sum of the revised AAC for the period it was in effect, plus the previous AAC for the period it is in effect.
v. AACs shall be revised when a new timber supply analysis is approved, or more than 2.5% of the net landbase is deleted. The AAC shall be reduced by an amount equal to the percentage of net landbase deleted.

2.0 Process

2.1 The mechanisms to address various circumstances that require AAC changes are presented in the standards that follow:

i. Timber supplies of all operators in an FMU may be affected by:
   a. Changes to the net landbase due to factors such as (but not limited to) updated inventory, fires, deletions for other land uses, changes to FMU boundaries, and changes in subjective or Operating Ground Rule deletions;
   b. Changes in yield projections;
   c. Changes in *utilization* standard; and
   d. Changes to mandatory or managed assumptions.

2.2 The revised AAC has been allocated using methods acceptable to Alberta.

The following applies:

i. Percentage allocations (coniferous timber quotas and some deciduous timber allocations)
   Where tenure documents allocate a percentage of the AAC, the volume allocated shall be the percentage multiplied by the revised AAC.
ii. Volume allocations (most deciduous timber allocations, some coniferous allocations)
   Where tenure documents allocate a volume, the volume shall be allocated if it is available after the percentage allocations are completed.
iii. Area allocation
   Where tenure documents allocate the timber on a specific area and state exemptions, the AAC minus the exemptions (in the following priority - percentage then volume) shall be allocated to the area allocation unless specified otherwise in tenure documents.

2.3 Changes that do not affect all operators in an FMU:

2.3.1 Over-cut adjustments have been deducted.

If an operator has an over-cut from a previous *cut control period*, the over-cut must be deducted from the available allocation.

2.3.2 Reforestation adjustments have been applied.

Where reforestation results in yield projection changes, the following mechanism shall be applied to adjust the resulting AACs.

i. Completed performance surveys shall be used to assign each harvested area to an appropriate yield stratum.

ii. Adjustments to allowable harvest volume will be made based on summarized results from regeneration performance surveys that demonstrate the regeneration stratum achieved is different than the target (forecasted) regeneration stratum at harvest. The procedures for changes to strata and adjustments to volume are outlined in Alberta's policy directive. The changes to the allowable harvest volume will be in effect until such time as a revised timber supply analysis is approved.

iii. Volume penalties for not completing EFM treatments shall be deducted from the allocation (see section 2.4).

2.4 Changes due to *Enhanced Forest Management (EFM)* have been allocated.

Any incremental *annual allowable cut* resulting from EFM practices shall be allocated to those operators participating and investing in the practices.

If all timber tenure holders agree to a shared management strategy involving a common set of silvicultural prescriptions, the authorized annual volume (V) for the participating operator in this situation shall be calculated as:

$$V=Q*E \qquad (1)$$

Where:

Q = the operator's entitled proportional share of *annual allowable cut*.
E = enhanced annual sustainable timber supply for the entire unit.

The same authorized annual volume may be expressed as:

$$V=(Q*N) + Q(E-N) \qquad (2)$$

Where:

N = non-enhanced annual sustainable timber supply for the entire unit;
E – N = allowable cut effect (ACE) of *enhanced forest management*.

Where the cost burden of EFM is not shared between operators in proportion to the current value of Q, the computation of authorized volume (formula 2 above) shall be modified as follows:

$$V=(Q_1*N) + Q_2(E-N) \qquad (3)$$

Where:

Q_1 = the operator's proportional share of the non-enhanced *annual allowable cut*;
Q_2 = the operator's proportional share of the ACE.

In this situation Q_1 shall be based on the operator's proportional share of the *annual allowable cut* as currently approved and indicated in tenure documents. Q_2 shall be calculated in one of two ways:

i. Operators, who are able to negotiate a cost-sharing agreement identifying the distribution of EFM costs among themselves, may request allocation if Q_2 accordingly.
ii. The ACE may be partitioned to represent differing treatments and levels of investment among operators. This requires computation of incremental levels of sustainable timber yield associated with the management strategies proposed and committed to by each operator. For example, if operators A and B both commit to *pre-commercial thinning* of all regenerated stands, but operator A also commits to *commercial thinning* of certain fire-origin stands, a minimum of three timber supply simulations would be required to compute and partition the ACE: (1) non-enhanced sustainable supply level, (2) sustainable supply level with *pre-commercial thinning* assumed for all regenerated stands, and (3) sustainable supply level with *pre-commercial thinning* assumed for all regenerated stands plus a schedule of commercial thinning as proposed by operator A.

If one (or more) operator plans no EFM participation within the implementation period of the FMP, their authorized volume and share of allowable cut shall continue to be computed as:

$$V=Q_1*N \qquad (4)$$

Normal provisions for maintaining the volume in the event of future reductions of allowable cut shall apply.

If one (or more) operator plans to participate in EFM at some point within the FMP implementation period (maximum 10 years), such time as when the operator commences full EFM operations, the operator's authorized annual volume (V) shall be computed as in Formula 4 above.

The volume penalty (P) for non-compliance with treatments scheduled in the FMP shall be accrued as:

$$P=((S-A)/S)*Q_2*(E-N)*5 \qquad (5)$$

Where:

S = area scheduled for treatment in the 5-year performance control period;
A = area actually treated in the 5-year performance control period.

Appendix B – Timber Supply and Reforestation Impacts from Wildfire

Wildfire impacts to timber supplies will be addressed in the following manner in timber supply analyses and reforestation strategies. A similar approach may be used for insect and disease outbreaks (i.e., Mountain Pine Beetle) or other disturbance events which impact timber supplies and productive forest land base.

Principles:

1. If wildfire has affected the net productive forest landbase of a *forest management unit* by more than 2.5% a revised AAC will be determined.
2. Burned area shall be removed from the productive forest landbase to determine the revised AAC.
3. Burned area may be included the productive forest landbase and contribute to the post-fire AAC given the following being met:
    i. The organization commits to reforest the landbase to provincial regeneration standards (or approved *alternative regeneration standards*). Managed stand yield assumptions will apply with the new reforestation start date.
    ii. Where the Organization does not commit to meeting regeneration standards, but does commit to conduct a survey acceptable to Alberta. A reduced yield assumption (i.e., low site, different yield stratum, lower density – e.g., AB) as compared to the pre-harvest covertype yield, will be applied.
4. Where the option exists, the Organization must make a decision on whether to reforest burned areas within one calendar year of the fire event.

Fire Salvage Areas

Optional reforestation applies to fire salvage areas which are administered under non-competitive direct allocations to existing forest tenure holders in the *forest management unit*. Areas that will not be reforested are removed from the productive forest landbase and timber supply analysis.

Mandatory reforestation applies to all areas sold under competitively sold commercial timber permits. These areas are part of the productive forest landbase and contribute to the AAC.

Burned Harvest Areas

If burned harvest areas are reforested, organizations may apply for an exemption from reforestation for specific harvest areas to the Executive Director of Forest Management Branch, (*Timber Management Regulation 143.7*). Once exempted, lands are removed from the productive forest landbase and timber supply analysis. To be considered 'reforested', harvest areas must have:

i. met the 2 year treatment requirement (TMR 141.1(1)), and,
ii. had the following treatments conducted: *site preparation* and planting, *site preparation* and Leave For Natural prescription, or straight planting.

Harvest areas that do not meet the above criteria will generally not be considered for exemption.

If burned harvest areas are not reforested, the reforestation clock start date is re-set to the date of the wildfire, the harvest area status and clock start date is updated in ARIS, and the new status of the harvest area (year 0 of reforestation) is accounted for in the timber supply analysis re-calculation.

If 50% or more of the area if a harvest area is burned, the entire harvest area is considered burned. If less than 50% of the harvest area is burned, only the burned portion is considered for a reforestation exemption and a new opening is created for the burned portion.

Unsalvaged, Potentially-Productive Landbase

See Principle number 3 above.

Appendix C – Reforestation Strategies

Reforestation of harvested areas is a critical first step in attaining the future forest condition selected through the forest management planning process. The reforestation phase of stand development (from harvest to about 20 years) represents the years in which significant silvicultural decisions and investments are made to create the forest types chosen as the *desired future forest*. Establishment phase (harvest to time where crop trees desired at final harvest can be considered established) and performance phase (from time of establishment documentation through to time where stands can be reasonably accurately determined to be on a specific yield trajectory) are recognized as key developmental phases where future forest condition may be substantiated as being probable[11]. Successful attainment of defined necessary conditions by the end of the regeneration phase provides early evidence that the forests and forest values are being managed in a sustainable fashion. Protection of coniferous understories in deciduous stands is required where it contributes to the AAC and the stands are classified as coniferous landbase. For stands classified as deciduous landbase, coniferous understorey protection is required as part of an incidental coniferous replacement strategy, or for identified non-timber values. Otherwise, understorey avoidance harvesting will be employed on the deciduous landbase, without specific pre-planning, target setting, or post-harvest monitoring requirements.

Reforestation Forecasting Tools Requirements

In order for desired stands to develop on trajectories and within timelines assumed in the FMP, a silviculture regime must be selected that is biologically and economically sound. Silviculture investment decisions must, therefore, be justified based on their likelihood of meeting reforestation targets. Defensible[12] regeneration models will provide the silviculturist the necessary empirical basis to select optimal establishment strategies as well as provide Albertans the assurance that sound silvicultural actions are being undertaken that will likely result in the *desired future forest* conditions assumed in the FMP.

Alberta requires that regeneration models be developed such that silviculture regimes that provide the highest likelihood of developing the tree and stand conditions required at the end of the performance stage are employed.

The development of regeneration models that integrate site conditions and silvicultural interventions are required to forecast and verify:

i. the probability of meeting performance standards,
ii. the need for, and timing of, silviculture interventions, and
iii. the relationship among stand and tree variables that are deemed likely to lead to the achievement of the regeneration targets[13]. (i.e., many small trees vs. few larger trees such that both sets of conditions will likely attain targets).

Due to the potentially highly variable nature of the interaction of site and treatment responses it is understood that regeneration models are likely to be probabilistic in nature. Interactive model development is likely to be required, with professional judgment combined with research trials and available monitoring data used initially. However, an appropriate monitoring design supplemented by targeted research trials will enable model refinement in the future.

Regeneration Model Requirements

Regeneration models shall forecast for each yield strata utilized in a FMP, at a minimum, the following stand variables:

- stocking,
- density, and
- species proportions based on minimum tree conditions within the regeneration phase and additionally;
- free-growing state at the performance phase.

These forecasts of stand conditions shall be made based on identified key site and vegetation factors at or before harvest that are known to mediate crop species establishment success and early growth performance. Key factors affecting silviculture effectiveness shall be model inputs and should include:

i. specific harvest considerations that may:

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[11] Regeneration phases as referenced in "A Framework for Regeneration standards Linked to Growth and Yield", final report to Alberta Forest Products Association, Edmonton by Dick Dempster Consulting Ltd. November 30, 2004.

[12] Defensibility as described in Ibid.

[13] Ibid.

- control propagule vigour/amount/distribution (i.e. shelterwood *residual tree* amounts and distribution, seed tree density and distribution) ,
- ameliorate site microclimate limitation (i.e. frost pockets, excess heat loads due to block size, location, orientation)
- maximize seedling recruitment (distance to seed source due to block size, orientation, *residual structure* strategies); or,
- negatively impact site physical conditions leading to poor silviculture success (summer harvesting impacts on aspen suckering and growth).

ii. physical site limiting factors such as excess soil moisture or low soil temperature and the associated need for, and type and timing of *site preparation* that address these limitations (i.e. mounding for microsite drainage)
iii. propagule sources of tree re-establishment such as LFN, seeding rates, planting density, or *understorey* protection and the associated specific required conditions (i.e. if LFN for pine, the necessary cone or seed, density and distribution target values); and,
iv. vegetation complexes likely to develop and the associated need for, and type and timing of vegetation management interventions (i.e. in wet, rich ecosites as defined by a PHA condition or ecotype map map, a broadcast herbicide treatment may be prescribed in the second year for *Calamagrostis canadensis* control).

Based on the regeneration models, generalized silviculture regimes (a listing of time-specific silviculture interventions) shall be developed for all recognized FMP strata that address how key site limiting factors will be addressed in order that the desired future stand conditions are likely to be achieved. Regimes must also be described for planned strata 'conversions' and replacement of secondary or 'incidental' tree species. The first iteration of such models may be simple decision tree documents, showing what site characteristics would trigger what silviculture interventions that are likely to achieve the desired stand conditions. Where highly variable outcomes are anticipated (due to inherent site, stand and/or treatment reasons) processes for appropriate identification and remediation of undesirable outcomes shall also be provided. The models shall forecast outcomes at times relevant to the timelines assumed in the FMP for the regeneration phase of stand development. Thus, for example, if establishment surveys are conducted at age 3 for one stratum, but at age 8 for another, the model must be capable of forecasting stand variables at these ages.

The following minimum level of detail is required in developing generalized treatment regimes:

Site preparation – mechanical vs. chemical
Planting – density (to the nearest 100) and species
Seeding – kilograms per hectare
Stand tending – mechanical vs. chemical
LFN – deciduous vs. coniferous
Seed/Vegetative Material collection – collection amounts required to meet standard 11.2 in the *Standards For Tree Improvement in Alberta* (one lot per seed zone)

Planning and Monitoring Standards for Partial Harvests

Introduction

Partial or non-clearcut harvest systems require specific consideration for planning and monitoring. The Partial Harvest (Non-clearcut) Planning and Monitoring Guidelines, Forest Management Branch July 2005 present a comprehensive discussion on the subject and should be referenced. *Clearcutting* with structure retention for biodiversity and wildlife habitat is not considered as partial harvest in this standard. For the purpose of this standard, *partial cutting* is considered to be:

i. Harvest of deciduous overstorey with coniferous *understorey* protection
ii. Commercial thinning
iii. Other partial harvests (pre-commercial thinning, shelterwood, seed tree or *selection harvesting*)

Principles

i. The goal of commercial thinning (CT) is to capture density-induced mortality thus attempting to increase the total merchantable volume captured from the stand. Thinning treatments will not increase the final harvest

volume or yield since physical and biological factors that limit tree and stand productivity cannot be typically increased by thinning alone. There must be diligence to not reduce stand productivity.

ii. The primary goal of pre-commercial thinning (PCT) is to accelerate stand development thereby reducing *rotation* length. Investments in PCT shall be linked to FMP forest level objectives. (i.e., TSA)

iii. While there are many potential benefits to *understorey* protection, experience in Alberta has shown that effective cooperation to achieve this potential is not possible at this time. As such, this standard is directed at separating stands into deciduous and coniferous landbases. Alternative options may be considered if all operators with an interest in an area reach an agreement acceptable to Alberta (or other specific direction is given in a FMA).

iv. *Understorey* protection shall be practiced in deciduous and coniferous stand types containing a white spruce *understorey*, or balsam fir where it is an approved species acceptable for reforestation.

v. Areas that are partial cut must be accurately represented in the FMP.

1.0 Deciduous Stands with Coniferous Understories

The management of coniferous understories in deciduous stands is a contentious matter on which there is little or no agreement among timber operators. Alberta's strategy is to clearly define the allocation of stands with understories to either the coniferous or deciduous landbase to make operational planning and reforestation less problematic, unless all affected timber operators reach an agreement on an alternative strategy acceptable to Alberta. Refer to Alberta Vegetation Inventory Standards Manual for the standards for *understorey* classification.

Standards for understorey protection harvests and monitoring are found in the OGR Framework for Renewal. Detailed understorey protection guidelines are provided in the *Partial Harvest (Non-clearcut) Planning and Monitoring Guidelines, Forest Management Branch July 2005*.

2.0 Commercial Thinning

2.1 The final yield (at assumed *rotation* or culmination of *mean annual increment*) has not been compromised through planning and thinning operations.

Commercial thinning must be conducted from "below" (removal of trees from the lower crown classes) to capture volume at the highest risk of mortality. Commercial thinning that reduces a stand's *growing stock* to levels below the optimum level of stocking will result in a reduced final yield at harvest.

2.2 Thinning plans have been submitted as a component of the AOP (Reforestation Program), to Alberta for approval.

Such plans shall contain the following information:

i. Specific objectives of proposed treatment(s).

ii. Description of treatments (i.e., what is to be removed), methods, and timing. Prescriptions based on "percentage removals " shall not be accepted due to the lack of uniformity between candidate stand conditions. Rather, crop plans must relate the number and type of trees to be removed to the desired future stand structure.

iii. Crop plans involving CT shall include pre-harvest assessment consisting of species composition, stand structure (height/density, stand table), live crown ratio, *slenderness coefficient*, total stand volume, and site index.

iv. Crop plans involving CT shall include a pre-harvest assessment consisting of species composition, density and site index.

v. Projection of total and merchantable yield and product value expectations for both treated and non-treated scenarios. It is up to the Organization to provide defensible evidence that the treatment will not reduce final harvest volume below that of the non-treatment scenario, nor increase *rotation* length.

vi. Preventative measures to be implemented to mitigate treatment-induced mortality due to windthrow, root injuries, *insects and diseases*.

vii. Impact of proposed treatment on specific wildlife species, fuel loading, and aesthetics, if not addressed in the FMP.

viii. RFP *validation*.

2.3 Thinning plans have been developed to achieve the operational and monitoring conditions.

Operational and Monitoring Conditions

2.3.1 Damage to residual *growing stock* during CT operations shall be limited to a maximum of 5% of a thinned stand. An individual tree must sustain less than 400 cm^2 of bole damage (bark removed to the cambium layer) to be excluded in the assessment of total stand damage.

2.3.2 A post harvest survey, acceptable to Alberta, shall be conducted to assess degree of damage and windthrow 3 - 5 years after the thinning treatment, in addition to post-harvest species composition, stand structure (height/density, stand table), live crown ratio, *slenderness coefficient*, total stand volume, and site index as compared to pre-harvest objectives.

2.4 Commercial thinning timber volumes exempt from AAC chargeability have been approved by Alberta and Alberta agrees that final timber yields will not be compromised.

In cases where excessive damage or mortality has occurred in response to thinning, Alberta may direct the Organization to harvest the entire remaining stand, and recommend that all volumes thinned and harvested be charged against the Organization's AAC.

2.5 Reforestation obligations have been determined and approved by Alberta.

Reforestation is not normally applicable, unless Alberta determines that a stand needs to be clearcut as a result of post harvest thinning damage, or loss of site occupancy for other reasons (e.g., *insects and diseases*). In such cases, the provincial regeneration standards (or *approved alternative regeneration standards*) shall apply.

3.0 Other Partial Harvests and Pre-commercial Thinning

3.1 Stand level plans (crop plans) contain the required information and have been submitted as part of the AOP to Alberta for approval.

Plans shall contain the following required information:

i. Specific objectives of proposed treatment(s) – e.g., regeneration of douglas fir, minimizing wildfire risk.
ii. Description of the silviculture system being employed (i.e., shelterwood, seed tree), and rationale for choice of system.
iii. Description of treatments – structure to be retained, in what distribution (mapped to 1:5,000), silviculture treatments, and timing of treatments.
iv. Preventative measures to be implemented to mitigate treatment-induced mortality due to windthrow, root injuries, *insects and diseases*.
v. Any proposed variation to regeneration survey timing, or alternate survey method and standard in the case of uneven-aged management.
vi. RFP *validation*.

3.2 A survey 3 to 5 years after treatment, to assess if structure was retained as planned, has been completed.

3.3 The Alberta Regeneration Survey Manual surveys and standards have been followed, unless otherwise approved by Alberta.

Appendix D – Alberta Forest Products Association – Harvest Planning Framework

The following paper is an excerpt from the Alberta Forest Products Association (AFPA), Forest Management Committee's September 15, 2005 response to its review of the Alberta Forest Management Planning Standard, draft 3. It is provided for information, and to stimulate further discussion on harvest planning frameworks for spatial harvest sequencing.

This appendix does not set alternative standards for FMPs. The requirements of the Alberta Forest Management Planning Standard are the standards to achieve for spatial harvest sequencing.

Attachment 2

6.0 Harvest Planning Framework

Baskerville[1] defines good forest management (and by extension, harvest planning) as "control of the temporal and spatial development in a forest so that it is consistently possible to achieve the desired quantity and quality flow of benefits for that particular forest." Baskerville further defines six characteristics of good forest management:

1. *There is a responsible manager, of a defined forest, with an explicit target forest structure that a management plan is attempting to reach. Given the dynamic nature of the world we live in this will normally be a moving target, therefore there are mechanisms in place for the systematic review of whet the target structure should be.*

2. *There is an analysis of the forest dynamics unique in this forest to define what characteristics of the present structure prevent attainment of the goal structure. Again since the target is moving, and since information on forest dynamics is increasing, there is a mechanism in place for more or less continual analysis in the unfolding future.*

3. *There is a specific designed solution that is directly referenced into the analysis of the problem. The solution explicitly states the temporal and spatial deployment of the four tools of forest management* [scheduling the harvest, allocating the harvest, silviculture and protection]. *There is complete consistency in the way the four tools of management are used with respect to their interdependencies on-the-ground.*

4. *There is an explicit implementation plan showing what is to be done, where and when. This is sufficiently explicit to allow realistic appraisal of the cost of implementation.*

5. *There is an explicit assessment and control procedure in place that is capable of detecting failure of management, whether this derives from pure failure to implement the management plan, or from failure of stands to respond in the forecast manner.*

6. *There is an explicit procedure in place to initiate redesign of management when failure is detected.*

The effectiveness of a harvest planning process can be evaluated by comparing against these characteristics. The "Spatial Harvest Sequence – Default Harvest Planning Process" described in the following section represents a generic means of achieving the characteristics of good forest management.

Alternative harvest planning processes are encouraged for a forest area where demonstrated to be an improvement relative to the characteristics of good forest management. The Terms of Reference would establish the intent to develop an alternative process, and the approach to development, review and acceptance by Alberta. Alberta will use the characteristics of good forest management as the criteria for evaluating alternative processes relative to the default.

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[1] Baskerville, G. 1986. Understanding Forest Management. For. Chron. 62(4): 339-347

Spatial Harvest Sequence – Default Harvest Planning Process

The default harvest planning process, designed to meet the characteristics defined by Baskerville, centers on developing a Spatial Harvest Sequence (SHS) for a 20-year period. The SHS forces a detailed operational plan into strategic analyses. This serves to ensure strategic plans are feasible to implement, and that the results of the strategic analyses are valid.

The purpose of the SHS is to estimate spatial allocation impacts on the strategic level AAC determination. It also serves as a template for implementation on the ground. Ideally, it will be followed rigidly. Where circumstances necessitate deviation beyond stated variance rules, industry will prove sustainability or follow the Alberta AAC adjustment rules.

Two types of compartment harvest design plans are possible inputs to the timber supply analysis: Final Harvest Plans (FHPs) are approved design plans – laid out in the field; and Modeled Harvest Plan (MHPs), a paper plan developed as part of the timber supply analysis procedure without any field information. A comparison of the types of plans, and the review and authority conveyed with each is shown in Table x.

Table x. Harvest design plan comparison.

Description	Harvest Plan		
	Modeled	**New Final (post-DFMP)**	**Existing Final (pre-DFMP)**
Design	Modeled blocks, no field recce	Requires field recce and layout	Blocks laid out
Alberta review	Design reviewed as part of the SHS with the DFMP.	FHP review evaluates consistency with SHS	Previously approved FHP, no review required.
Authority	Blocks can be included in FHP submission.	With FHP approved, stands/blocks listed can be included in AOP.	With FHP approved, stands/blocks listed can be included in AOP.

DFMP Timber Supply Analysis Results

Outputs from the timber supply analysis include: Spatial Harvest Sequence (SHS), a list of stands scheduled for harvest during each of the first two decades; Strata Description Table (SDT), listing the area by strata by compartment scheduled for harvest during each of the first two decades. Submission requirements for the first two decades of the planning horizon include:

- Mapped SHS (hardcopy and digital), showing stand/block boundaries and timber strata
- SDT (hardcopy and digital), harvest timber types and ages by compartment.

Compartment Harvest Design Plans

Where the SHS can be implemented within the following tolerances, with RFP validation, preparation of the Final Harvest Plan for a compartment can be expedited:

- Planned area within the compartment must be within 100% of the SHS area
- No more than 20% of the SHS area is substituted in the compartment

or

- Planned area by yield stratum within any compartment must be within 110% of the SHS area
- Planned area of any stratum can not exceed 100% of the 10-year SDT stratum area

Where these tolerances are exceeded, procedures outlined in Table y will be used to assess corrective action. Alternative tolerances and corrective actions may be identified in the Terms of Reference and defined in the DFMP where appropriate and consistent with the intent of Table y.

Table y. Corrective actions for exceeding SHS / SDT tolerances.

Tolerance	**Corrective Action when Tolerance Exceeded at**	
	Compartment-level	**Forest-level**
Planned area > 100% SHS area	Review rationale with Alberta	n/a
Planned substitution > 20% SHS area	SHS may be abandoned and SDT adopted with justification to Alberta	n/a
or		
Planned yield stratum > 110% SHS area	Overharvest of yield stratum in compartment indicates potential bias – assess forest-level status and report to Alberta.	n/a
Planned yield stratum >100% 10-year SDT yield stratum area	Permitted	Overharvest of yield stratum indicates potential bias, assess potential impact on contributing landbase and AAC

Monitoring, Reporting and Corrective Action

Being spatially explicit, the SHS provides an unambiguous basis for performance monitoring – both in terms of assessing plans for future activity, and actual performance. A key focus in preparing operational harvest plans is to assess the significance of deviations from the SHS. The DFMP will establish forest-specific tolerances and appropriate corrective actions for exceeding tolerances.

Periodic forest-level comparison of actual harvest to the SHS provides a measure of confidence in meeting plan objectives for timber and non-timber values. For example, sustainability of timber harvest may be impacted by:

- Avoidance (deletion or deferral) of low productivity or poor covertypes in planned or actual harvest areas
- Operational deletions not addressed in the net landbase
- Inventory changes that result in changes to the landbase/operator designation

Figures 1 through 3 provide examples of monitoring performance of these measures through the implementation of harvest plans. Figure 1 shows an example comparison made between Final Harvest Plan and the DFMP-assumed contributing land base. This comparison can be made at the compartment-level, or rolled up to the forest-level for a broader perspective.

In Figure 2, the red-circled area shows a stratum that has been overharvested in the current 10-year period. The yellow-circled strata are those that are underharvested in the current 10-year period, however, this will normally be the case until the final year of harvest in the 10-year period. Of concern are those strata that are biased with respect to the proportion of area that would have been expected to be operated by that time. An analysis of the combined period-to-date and forecast harvest schedule (e.g. Figure 3) would provide a prediction of expected status at the end of the current 10-year period. Corrective actions for undesirable variances would include changes to the harvest schedule.

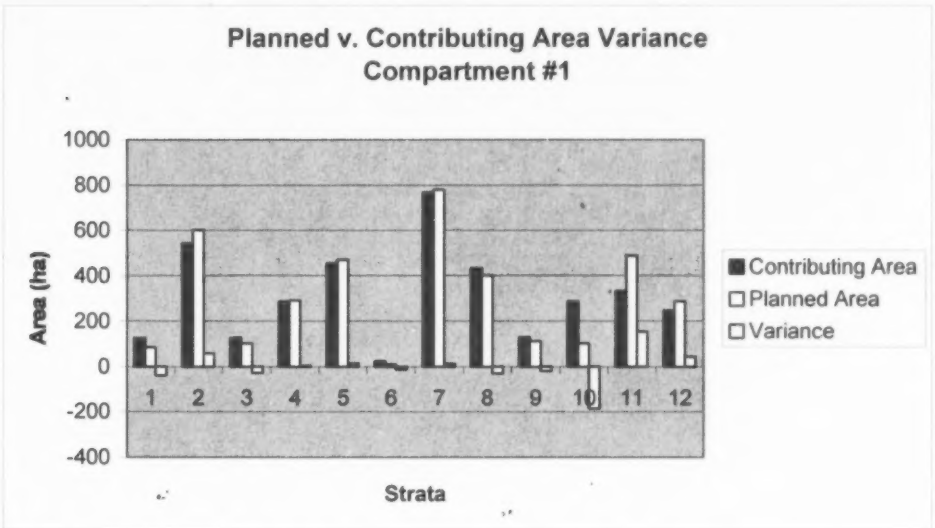


Figure 1. Example variance report for planned area versus DFMP-assumed contributing.

The DFMP will specify performance monitoring measures (type and reporting method), tolerance for variance, and corrective actions to be undertaken when tolerances are exceeded. Corrective actions must be effective at achieving the features of good forest management, specifically the response must reflect the significance of the failure detected and implication to overall success of the DFMP. Corrective actions may encompass any combination of revising operating plans, additional performance monitoring, reassessing resource analyses (timber or non-timber), to a complete restatement of the resource analysis.

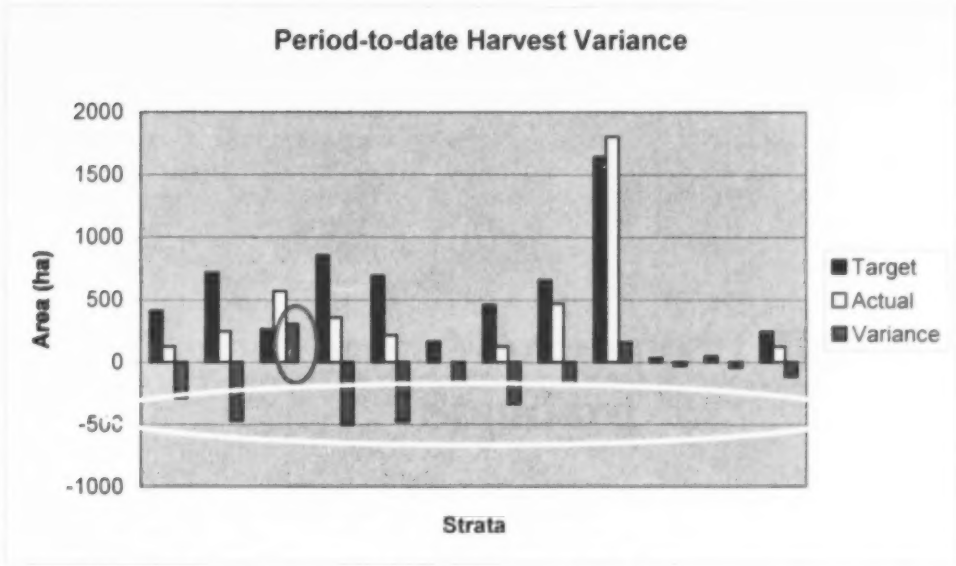
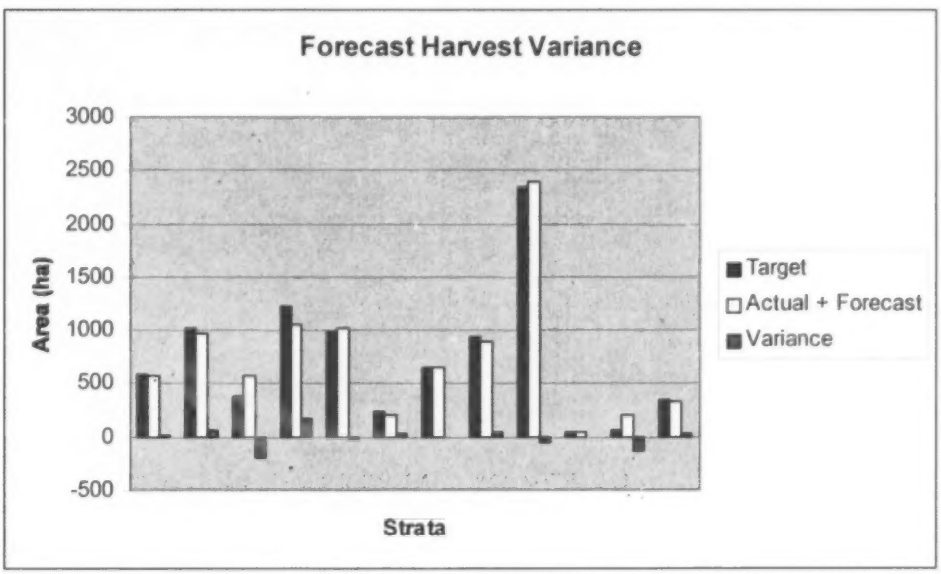


Figure 2. Example variance report for harvest area by strata.



Alberta Forest Management Planning Standard

Annex 2

Role of Regulated Forestry Professionals in Forest Management

Alberta Sustainable Resource Development
Public Lands and Forests Division
Forest Management Branch
Version 4.1 - April 2006

Annex 2
Role of Regulated Forestry Professionals[1] (RFP) in Forest Management

The Alberta Government is committed to sustainable management of forests on public land to provide benefits and opportunities for Albertans. Alberta relies on the professional integrity of RFPs to enhance the effectiveness of forest resource management planning, implementation and harvest activity, while recognizing the interdisciplinary nature of forest management planning.

Alberta requires a RFP to submit the components of forest management plans, annual operating plans and harvest activity reporting, as identified in this annex, for approval.

1.0 Validation by a RFP

RFPs shall validate their submitted work by one of the following methods:

i. Signing using their professional title and registration number, or
ii. Stamping and signing using the seal provided by a *College*, or
iii. Using other mechanisms approved by Alberta.

1.1 Significance of RFP Validation

RFP *validation* provides assurance to Alberta that work is *accurate* and has been prepared with *due diligence*. Government RFPs shall review *validated work* by conducting a reasonable assessment for accuracy and shall take appropriate *corrective actions* where *validated work* is not *accurate*.

The documentation required to demonstrate *due diligence* is viewed as a significant source for validating accuracy. Alberta will not accept inadequate documentation and may refer such occurrences to the Complaints Director of the appropriate *College*.

1.2 Approval of Validated Work

Alberta's approval does not transfer the accountability for the plan or its implementation from the Organization or the submitting RFP to Alberta or its staff. Government RFPs who review submissions are accountable for their reviews and any direction provided to the Organization. *Approval* of *validated work* shall be addressed as described below.

1.2.1 Appraisal

Work with far-reaching and significant potential effect if inaccurate (such as but not limited to timber supply analysis, GDP). *Validation* of this type of work demonstrates confidence the work is *accurate*; however, due to its potential significance, it is both necessary and important to examine the work carefully. Approval shall be granted after the work has been reviewed by appropriate RFPs to assess accuracy. The timeline for this shall be established by Alberta and will vary depending on the nature of the *validated work*. Those preparing work for appraisal are advised to communicate with the reviewing government RFPs regularly and effectively to minimize confusion over the standards expected of the work.

1.2.2 Acceptance

Work with a more limited potential effect (such as, but not limited to silviculture reports, operations inspections). The work is considered approved on the date Alberta acknowledges receipt of the work. Alberta shall notify the organization by acknowledging receipt within 5 working days of submission. Alberta shall periodically check the work and supporting documentation to verify its accuracy.

[1] Refer to Alberta Definitions

2.0 Work Validated by a RFP

All entities that conduct timber harvesting or silvicultural activities on public land, except those harvesting less than 30,000 m^3 annually from public land, must validate the items described below (the list of work to be validated may be amended from time to time by Alberta to adapt to change).

2.1 Forest Management Plans

The entire *forest management plan* shall be approved through an appraisal and must be validated by the senior RFP responsible for its preparation.

The following components must be validated by the RFP most directly responsible for their preparation. A RFP validated checklist describing the extent of compliance with applicable standards for each component shall be included with each submission:

i. Yield projections and all associated data and analyses – for appraisal
ii. Vegetation inventory data – for appraisal
iii. Landbase description (analysis and report) – for appraisal
iv. Silviculture strategies (see Annex 1, standard 5.6 on managed assumptions)– for appraisal
v. Forecasting (timber supply analysis) – for appraisal
vi. Harvest planning (*spatial harvest sequence*) - for appraisal
vii. Monitoring reports - annual - for acceptance; stewardship – for appraisal

2.2 Annual Operating Plans[2]

The minimum *validation* requirements are as follows:

i. General Development Plan – for appraisal
ii. Compartment Assessments - for appraisal
iii. Final Harvest Plan – for acceptance[3]
iv. Road Plan and Fire Control Plan – for acceptance
v. Reforestation Program – for acceptance[4]

2.3 Harvesting and Reforestation Activities

Accurate and timely submission of timber production and sales information is important and must be validated. The activities related to reporting timber production and sales must be approved by the senior RFP responsible for the submission.

The following forest management reports must be validated by the RFP directly responsible for their preparation:

i. Scaling populations (TM262) – for appraisal
ii. Timber production audits – for acceptance
iii. Letters of Understanding – for appraisal
iv. Statutory Declarations of production – for appraisal
v. Harvest tenure standings – for acceptance
vi. Timber production reporting – for appraisal
vii. Reforestation information - regeneration surveys, ARIS submissions and silviculture operations reports, regeneration stratum declaration, stratum change, quadrant allowable cut adjustment, and final performance reports – for acceptance
viii. Field operations inspection reports – for acceptance
ix. Herbicide reports – for acceptance

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[2] AOPs are approved subject to an appraisal by Alberta. Where a compartment assessment has been completed the CA, FHP and AOP shall be appraised by Alberta.

[3] The notification date will be documented by Alberta as the start date for FHP approval.

[4] Where thinning plans, herbicide plans, and reforestation prescriptions vary from FMP silviculture strategies the reforestation program shall be appraised by Alberta.

Alberta Forest Management Planning Standard

Annex 3

FireSmart Management

Alberta Sustainable Resource Development
Public Lands and Forests Division
Forest Management Branch
Version 4.1 - April 2006

Annex 3

FireSmart Management

1.0 Introduction

FireSmart seeks to mitigate large, high intensity, high severity wildfires and incorporate natural disturbance emulation. Designing FireSmart by integrating fire, forest and land management planning activities is the cornerstone of protecting a multitude of values, achieving safety, meeting planning objectives and ultimately attaining *sustainable forest management*. FireSmart also identifies opportunities to use prescribed burning as a natural disturbance management strategy to meet ecological objectives through ecological restoration. FireSmart is a building block of all elements wildfire prevention (engineering, education, enforcement). For more information on FireSmart refer to the Alberta Forest Protection website[1].

1.1 FireSmart Planning

Fire management planning in Alberta is an integral part of *sustainable forest management*. Planning tools to address wildfire threat and apply FireSmart can be used for long-term and strategic, *temporal* and spatial scales, or "real-time" operational plans.

FireSmart can be applied at various scales including the local or community scale, sub-regional or DFA scale, regional or wildfire management area (WMA) scale, or provincial scale. It is important to include both the active and passive land base when designing *FireSmart landscapes* at these various scales. Each scale is mutually dependant on one another. Uncontrolled wildfire may spread between landscapes, communities, and *wildland urban interface* more readily and more intensely where FireSmart strategies have not been applied. For example, efforts to make a community FireSmart may be compromised if the landscape or structures/developments surrounding/or within the community are not also FireSmart. During multiple fire scenarios, *suppression capability* is limited and all values may not be protected. This makes it critical to proactively apply a FireSmart approach at various scales.

1.2 FireSmart Implementation

We live and operate in a fire dependant ecosystem. Fire is an important and inevitable part of Alberta's forests. Historically, fires fulfilled an ecological role that helped to create the varied mosaic of landscape *pattern* and diversity now present in the province. However, fire exclusion through decades of effective fire suppression has resulted in deviation from natural fire regimes. Periodic fires that would have occurred naturally have been deferred. The consequences of suppressing fires in some areas are increased fuel loading and undergrowth, older age classes, continuous fuels and increased forest density creating a natural tinderbox. These consequences combined with Alberta's drought patterns and climate change heightens the severe and persistent threat ecologically, economically and socially.

As forest harvesting progresses through lengthy *rotation* periods the challenge will be the development of a compensatory relationship between wildfire events and harvesting patterns. Through a *landscape fire assessment* a greater understanding of the fire environment will reduce the challenge by helping to strategically align both fire and forest harvesting to reduce additive impacts.

Globally there is an increasing recognition of the need to integrate fire and forest management. Managing threat associated with fire requires integration of fire management with other land uses and decisions to integrate a broader set of values. This will enable *adaptive management*, innovations in the current theory and practice of fire management and ecological, social and economic benefits[2]. Fire must be a priority in planning to fully realize other management strategies.

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[1] Visit Alberta's Forest Protection Website at http://www3.gov.ab.ca/srd/wildfires/fpd/ for more information

[2] Refer to "FireSmart Landscapes - A Discussion Paper", FPD, 2001) available from Alberta on request.

1.3 Timing

Traditionally forest management planning has been an outcome, which has reacted to or excluded fire. A proactive approach is required in managing fire to produce *desired future forest* conditions. Acknowledgement of fire suppression capabilities, principles and limitations combined with climate effects, human impacts and the current forest conditions all support the need for a fundamental shift in fire management planning. Managing fire by shifting from short-term readiness (reactive) to long-term preparedness (proactive) is critical to achieve value protection, safety and *sustainable forest management*.

1.4 Methods

Part of a Landscape Assessment will include a *Landscape Fire Assessment*, integrated into existing forest management planning. FireSmart planning uses a framework involving the use of a *Landscape Fire Assessment* that evaluates the positive impacts of wildfire through a fire regime analysis and the negative impacts of wildfire through a wildfire threat assessment. (See Figure 1) Both are required to fully understand the fire environment by evaluating the interaction between fuels, weather and topography leading to prioritization, mitigation of threat and ecological restoration.

A *landscape fire assessment* requires the following steps:

1. *Assess the current wildfire threat potential for the DFA both spatially and temporally*
2. *Assess the fire regime (natural disturbance regime) for the DFA*
3. *Develop objectives, targets, strategies to reduce wildfire threat and enhance ecological attributes of wildfire*
4. *Assess impacts and indicators*
5. *Monitor implementation*

The benefit in this process is in how it guides what strategies need to be applied and where they need to be applied.

1.5 Approach

Cooperative efforts are necessary to address FireSmart. This initiative is one that a fire management agency, department or stakeholder cannot do alone. The fact that fire does not respect administrative boundaries reinforces the need to integrate management practices to address wildfire. Collaboration, participation, and co-operation with various stakeholders are needed to discuss and provide options and opportunities. Interagency co-operation and joint responsibility of fire management, among forest managers, fire managers, wildlife managers, Aboriginal people and stakeholders (i.e., industry, public, energy, etc.) is essential. Specific responsibilities are identified in Section 2.0.

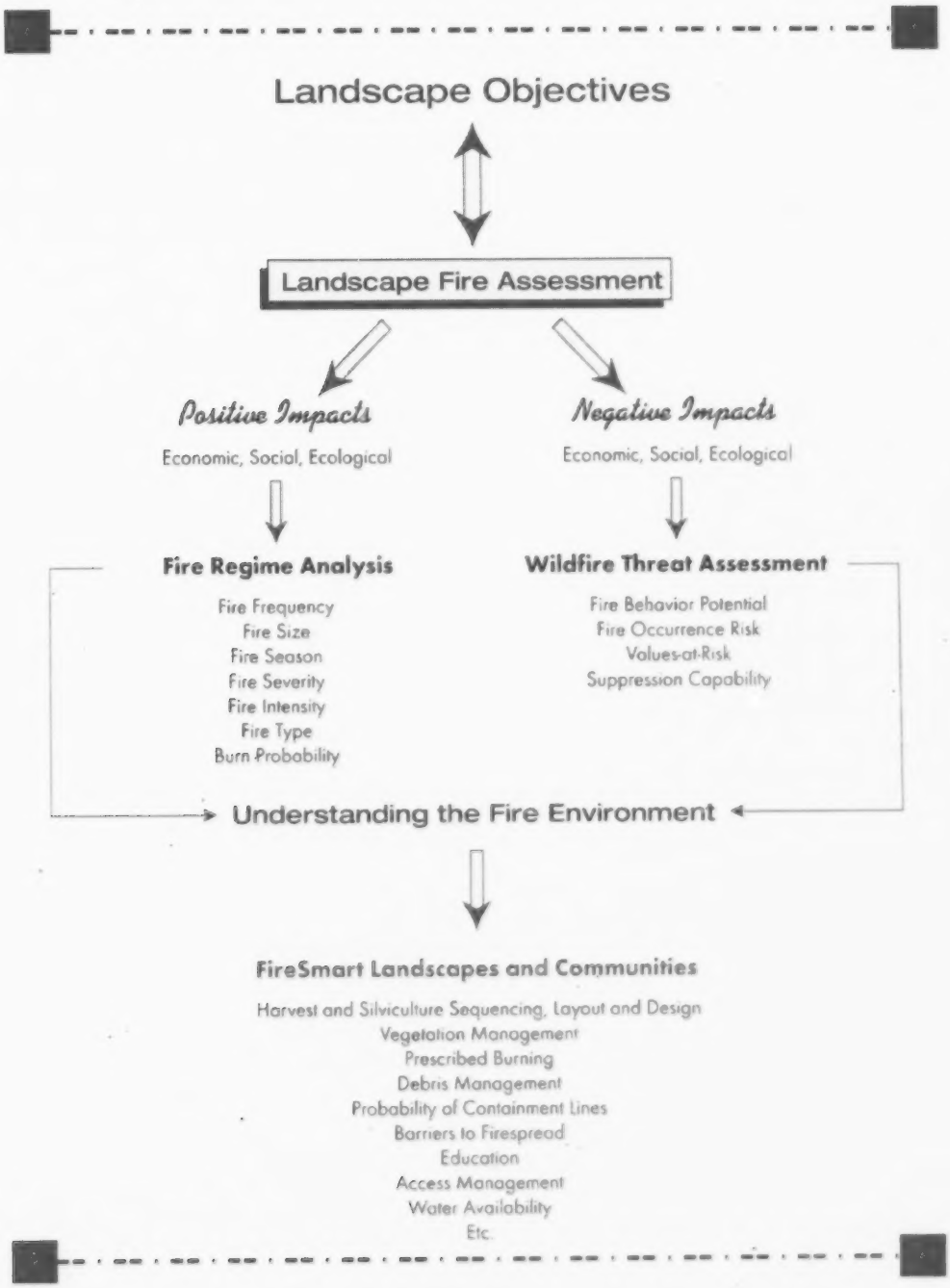

Figure 1. Landscape Fire Assessment Flowchart.

2.0 Roles and Responsibilities

2.1 The Organization has led a *landscape fire assessment* for the DFA. (See Figure 2)

This approach will ensure seamless and consistent products utilized in provincial fire and forest management planning and operations. The wildfire threat assessment model and data are available from Alberta. This information will be provided at larger spatial scales greater than the FMA to ensure proactive planning and evaluations to deliver management objectives. Obtaining wildfire models will require the completion of specific training courses and/or licences. Contact the local Wildfire Prevention Officer for details.

2.2 Current models and data necessary for Wildfire Threat Assessment have been acquired from Alberta.

Alberta will provide the organization with the Wildfire Threat Assessment model and associated data (Provincial) and available fire regime information (i.e., Provincial Fire Regime Analysis) to offer guidance at a larger scale and provide information inside/outside FMA boundaries to aid in broader landscape level planning. See Figure 3.

2.2.1 Data has been made available to Alberta upon request.

Alberta requires current information to ensure the wildfire threat assessment model is appropriately calibrated for local conditions.

This data and information includes:

- Updated *Values at Risk* information which may include but is not limited to
  - Critical age class information
  - Active/passive land base information
  - Depletions
  - AVI 2.1
  - FBP fuel information
  - Access
  - Linear disturbances
  - Critical *watershed* information
  - Critical habitat information
  - Research and monitoring data
  - PSPs, genetic sites, *sensitive sites*
  - *Water availability*
  - Other timber value information

2.2.2 The Organization has chosen FireSmart strategies.

FireSmart strategies are not provided by Alberta with the Provincial Wildfire Threat Assessment.

2.2.3 The Organization has collaborated with Alberta and other key stakeholders within the Wildfire Management Area.

Establishing a FireSmart committee to assist with integrating fire into planning activities is recommended.

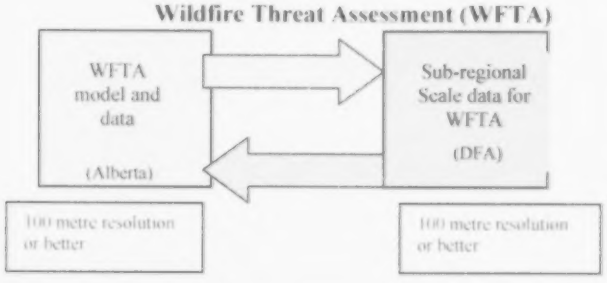

Figure 3: Initiation of Wildfire Threat Assessment

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  - Depletions
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  - FBP fuel information
  - Access
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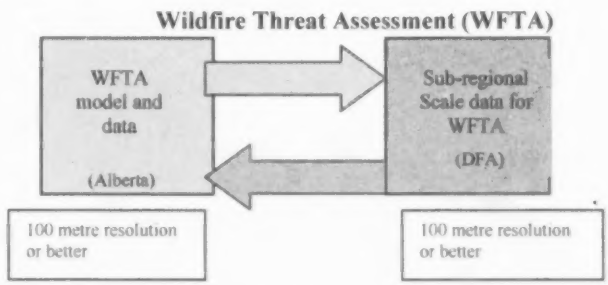


Figure 3: Initiation of Wildfire Threat Assessment

2.2.4 **The current wildfire threat assessment model has been used to assess wildfire threat on the DFA.**
When the organization submits data to support the wildfire threat assessment model, Alberta will update the model and provide the most recent version. Alberta will assess the FireSmart strategies developed for the DFA at both regional and sub-regional or local scale to make sure alignment at the various scales is consistent.

DFA-scale Assessment:

2.3 A *landscape fire assessment* has been completed for the DFA.
It is recommended that the *landscape fire assessment* extend beyond the DFA boundary a minimum of 2 townships to assess any threat immediately adjacent to the DFA. This utilizes the wildfire threat assessment model to analyze outputs and identify areas on the landscape threatened by wildfire both spatially and temporally. This also requires combining components of a fire regime analysis to analyze outputs to emulate natural disturbance and achieve ecological objectives.

2.3.1 The FMP forecasts fire behaviour potential for the *planning horizon* at specified increments. (See Forecasting Section 4.0)
This does not exclude strategies chosen to achieve other objectives stated in Section 3.2.1

2.3.2 The preferred scenario considers strategic FireSmart planning in priority areas, based on the *landscape fire assessment.*

2.3.3 Submissions for review and approval are complete and meet Alberta's requirements.
Requirements include:

a. Submission of updated data required for processing, reviewing and approval specific to FireSmart initiatives for the FMA.
b. Completion and submission of forecasted fire behaviour potential based on specified time periods FMA.
c. Completion and submission of the fire regime analysis report for the FMA.

3.0 Forest Protection Values, Priorities and Objectives

A number of VOITS are identified and shall be included in the FMP.

3.1 Values
Alberta's priorities for the protection of values are as follows:

i. Human Life
ii. Communities
iii. *Watershed*/Soil
iv. Natural Resources
v. Infrastructure

3.2 Objectives
Alberta's objective is to protect public forests and forest communities by preventing and suppressing wildfire.

3.2.1 Fire management objectives have been developed to reduce wildfire threat potential and enhance the positive attributes of fire.
The following is to be achieved:

A. Reduce wildfire threat potential by,
i. Reducing fire behaviour potential
ii. Reducing fire occurrence risk
iii. Reducing threat to *values at risk*
iv. Enhancing *suppression capability* (e.g., a reduction in overall wildfire threat may be accomplished through enhanced access, *water availability*)

B. Enhance positive attributes of fire by,
i. Emulating landscape patterns historically created by natural disturbance

Indicators

3.3 The FMP identifies targets for indicators of wildfire risk (Annex 4).

Indicators for wildfire risk are:

FireSmart Communities

i. Percentage reduction in fire behaviour potential area (ha) within the *FireSmart Community Zone*.
ii. Area (ha) of *prescribed burn* within the *FireSmart Community Zone*.

FireSmart Landscape

i. Percentage reduction in fire behaviour potential area (ha) across the DFA now and over the *planning horizon*. i.e., *FireSmart Landscape Zone*
ii. Area (ha) of *prescribed burn* across *FireSmart Landscape Zone*

4.0 Forecasting

The process for evaluating FireSmart strategies to indicate the change in fire behaviour potential over the *planning horizon* is required. Fire behaviour potential is a temporally modelled parameter used to judge how successful strategies may or may not be. Other viable strategies to reduce wildfire threat and enhance positive attributes of wildfire that may not be temporally modelled at this time are just as appropriate and should be included in the overall scenario. Alberta will provide wildfire threat assessment data for year 0. Alberta may also provide the organization *temporal* analysis at the regional scale if available.

4.1 Spatially explicit information for the preferred management strategy at 0 years, 10 years, 20 years, and 50 years has been included in the FMP.

Analyzing fire behaviour potential over the *planning horizon* will provide effective FireSmart strategies (i.e. vegetation management) and provide consistent data to evaluate and review at the local, sub-regional (FMA) and/or regional (WMA) scales. The Organization provides the forecast to Alberta, which will incorporate it and other FMA forecasts, at a future date, into a forecasted regional wildfire threat assessment.

Each FireSmart strategy based on forecasting scenarios and overall *landscape fire assessment* must be evaluated to determine whether all objectives are being achieved and determining which strategy are most appropriate.

As each alternative scenario, *sensitivity analysis* or series of analyses are completed they must be analysed and evaluated against the original fire management objectives. If the results are unacceptable it will be necessary to revisit and adjust one or more components within the *evaluation* process.

4.2 Alberta's 4-step process has been used to forecast the relationship between harvest sequence patterns and fire behaviour potential.

This must be combined with other strategies to achieve an overall reduction in wildfire threat while meeting other objectives over time.

The forecasting steps are as follows:

<u>Step 1</u>

4.2.1 Obtain the most current regional wildfire threat assessment and model and utilize the spring, summer and/or fall season (which ever seasons are more problematic for the DFA) for the current forest condition.

The wildfire threat assessment is a key process that evaluates the current condition of the forest and the potential negative impacts of wildfire. Fire behaviour potential, fire occurrence risk, *values at risk* and *suppression capability* are 4 components combined to evaluate and identify those areas on

the landscape/DFA most threatened by wildfire. Assessing each component is key in determining which component(s) drive the wildfire threat. This aids in prioritizing strategies to proactively reduce overall wildfire threat potential via reduction of fire behaviour potential, fire occurrence risk, wildfire exposure to *values at risk* and the enhancement of *suppression capability*. The Wildfire Threat Assessment User Guide and Alberta Forest Protection training courses provide specific *guidelines* to complete a wildfire threat assessment[3].

Step 2

Create new Fire Behaviour Potential (FBP) fuel grid layers that incorporate all planned cutblocks using the SHS for 0, 10, 20 and 50 years.

Step 3

Create the forecasted fire behaviour potential grid layers based on the new fuel grid layers produced in Step 2. (i.e. HFI grid layer grid layer, CroSuM grid layer*, Fire Behaviour potential grid layer, etc). The remaining layers of the wildfire threat assessment may remain static (i.e., *values at risk* and its factors, fire occurrence risk, and *suppression capability* and its factors if unable to be forecasted at this time). Wildfire threat or fire regime inputs may be incorporated into other *temporal* models if feasible.

Step 4

Examine the changes to fire behaviour potential from the proposed SHS and modify if required.

Reporting

5.0 Summary reports of FireSmart strategies have been included in the AOP in a format acceptable to Alberta.

For a list of potential FireSmart strategies visit
http://www3.gov.ab.ca/srd/wildfires/fpd/pwf_fs_firesmart.cfm

[3] Refer to the Wildfire Threat Assessment and Forecasting User Guides on the Alberta FPD website Alberta website at http://envweb.env.gov.ab.ca/env/forests/fpd/flash.html

* CroSuM grid layer to be used if AVI 2.1 is available for the entire DFA. Wildfire ignition probability potential (WIPP), a factor in fire occurrence risk also contains a fuel layer and may be used in the forecasting process if available

Alberta Forest Management Planning Standard

Annex 4

Performance Standards

Alberta Sustainable Resource Development
Public Lands and Forests Division
Forest Management Branch
Version 4.1 - April 2006

Performance Standards

The mandatory values, objectives, indicators and targets (VOITs), identified by Alberta in this Annex shall be included in FMPs.

Quantitative targets shall be developed by the Organization in consultation with stakeholders and rationalized based on social acceptance, sound science, credible analysis techniques, and clearly stated value trade-offs. Alberta has established minimum performance standards to be addressed in Forest Management Plans. This Annex provides the framework for linking values to clear objectives and measurable indicators and targets.

The Indicators and Targets presented are less definite than the Values and Objectives. Alberta will consider alternative Indicators and Targets if they meet the general agreement of stakeholders and Alberta believes they provide similar confidence that they are reasonable given the Values and Objectives.

It is recognized that several targets are not entirely under the control of the forest manager. For example, considerable emphasis is placed on access limitations, but the amount of access is largely affected by other industrial users. In these instances, the VOITs suggest reporting on the results with the view that the forest manager can be responsible for reporting on the target, but is not exclusively accountable for addressing the results.

ANNEX 4 - Performance Standards

CCFM Criterion	CSA EFM Element	Value	Objective	Indicator	Target[1]	Means to Identify Target[2]	Legal / Policy Requirements	Means of achieving Objective and Target[3]	Monitoring and Measurement	Reporting	Acceptable Variance	Response
1. Biological Diversity	1.1 Ecosystem Diversity Conserve ecosystem diversity at the landscape level by maintaining the variety of communities and ecosystems that occur naturally in the DFA	1.1.1 Landscape scale biodiversity	1.1.1.1 Maintain biodiversity by retaining the full range of cover types and seral stages[4]	Area of old, mature, and young forest in each DFA subunit[5] by cover class[6]	Over the 200-year planning horizon: a) Gross landbase: greater than X% old forest, greater than Y% mature plus old forest, less than Z% young forest, and b) Net landbase: greater than X% old forest, greater than Y% mature plus old forest, less than Z% young forest Note: Old forest retention shall include the full natural range of ages	Targets and seral stage definitions shall be based on sound science, ecological considerations, wildlife zones, and disturbance regimes Target shall ensure representation of natural range of ecosystem attributes (e.g., productivity class)	Planning Standard	Spatial Harvest Sequence	Regular updates to inventory	FMP: Tables of indicators (values and targets) at 0, 10, 50, 100, and 200 years Maps of indicators at 0, 10 yrs, 50 years Performance: Stewardship Report	Area (ha) of old and mature forests in each DFA subunit by cover class shall be between 90% and 100% of target area Area of young forest in each DFA subunit by cover class shall not exceed 110% of target area	Adjust strategies in subsequent FMP
			1.1.1.2 Maintain biodiversity by avoiding landscape fragmentation	a) Range of patch[7] sizes by subunit and entire DFA	a) A distribution of harvest area sizes that will result in a patch size pattern over the 200 year planning horizon approximating patterns created by natural disturbances	Targets shall be based on sound science, ecological considerations, wildlife zones, and disturbance regimes Target shall ensure representation of natural range of ecosystem attributes (e.g. cover class and productivity class)	Planning Standard	Spatial and temporal harvest planning. Patch size distribution targets are set for forest patches less than 20 years old	Regular updates to forest inventory	FMP: Tables of area of forest in each patch size class by subunit at 0, 10, and 50 yrs (or end of first rotation) Maps of patch size classes at 0, 10, and 50 yrs, (or end of first rotation) Performance: Stewardship Report	a) At the end of the 10-year FMP term the target distribution is achieved; or demonstrated progress to achieving target in one rotation where the pattern has deviated significantly from the target	Adjust strategies in subsequent FMP
				b) Area of old interior forest[7] of each cover class by subunit and entire DFA	b) Area of old interior forest will not be less than X% of each cover class over the next 200 years	Targets shall be based on sound science, ecological considerations, wildlife zones, and disturbance regimes Target shall ensure representation of natural range of ecosystem attributes (e.g. productivity class)	Planning Standard	Spatial and temporal harvest planning	Regular updates to forest inventory	FMP: Maps and Tables of indicator at 0, 10, and 50 yrs Performance: Stewardship Report	b) Target is achieved for at least 80% of the planning period with variance not exceeding 20% below target	Adjust strategies in subsequent FMP
			1.1.1.3 Maintain biodiversity by minimizing access	Open all-weather forestry road density by subunit	Less than X km/km^2	Targets shall be based on sound science, ecological considerations, harvest planning, wildlife zones, and social values	Planning Standard	Develop a strategy that coordinates access with other resource users, spatial/temporal sequencing of harvest, road closures and decommissioning (SHS and long-term corridor access plan)	Regular updates to forest inventory	FMP: Table of road density by subunit at 0 and 10 years Map of existing and proposed open and closed all weather roads Report forestry roads and total (all users) roads Performance: Stewardship Report	A variance not exceeding +/-20% must be achieved	Adjust strategies in subsequent FMP

ANNEX 4 - Performance Standards

CCFM Criterion	CSA SFM Element	Value	Objective	Indicator	Target[1]	Means to Identify Target[2]	Legal / Policy Requirements	Means of achieving Objective and Target[2]	Monitoring and Measurement	Reporting	Acceptable Variance	Response
				Open seasonal / temporary forestry road length by DFA	Less than X km by subunit	Targets shall be based on sound science, ecological considerations, harvest planning, wildlife zones, and social values	Planning Standard	Road construction, maintenance and reclamation activities	Road plan OGR 11.2	AOP and Stewardship Report	A variance not exceeding +/- 20% must be achieved.	Adjust strategies in subsequent AOPs
			1114 Maintain plant communities uncommon in DFA or province	Area or occurrence of each uncommon plant community within DFA	X% of identified community will be maintained (separate target for each identified community	GIS analysis, AVI, ecosite phases, Alberta Natural Heritage Information Centre (ANHIC) plant community classification and tracking list. Predict and identify occurrence of uncommon plant community	Planning Standard	Coordinating with other resource users, spatial planning of harvest and road construction, OGR	Regular updates to inventory	FMP: Table with descriptive list and targets Map(s) displaying known locations of uncommon plant communities Performance: Stewardship Report	At the end of the 10-year FMP term the target is achieved	Adjust strategies in subsequent AOPs
			1115 Maintain unique habitats provided by wildfire and blowdown events	Area of unsalvaged burned forest	Live trees: Retain all unburned trees in green islands and retained patches recognizing timber condition, access, near timber needs Burned trees - Compartment Scale: Retain greater than 10% of merchantable black trees in patches greater than 100 ha Burned trees - Harvest Area Scale: Retain greater than 10% of merchantable black trees in patches 10 -100 ha; and Retain greater than 5% of merchantable black trees in small patches, single trees according to loggers choice	Targets based on "Fire Salvage Strategy: Forest Management Planning and Operations 2002" Ensure consistency with FireSmart objectives	Fire Salvage Strategy: Forest Management Planning and Operations 2002 (Forest Operations Branch, Alberta)	Salvage planning	Organization reports, air photo interpretation, ground surveys, post harvest assessments	FMP: Table and map of natural disturbances within the last 10 years -salvaged and unsalvaged Report area (ha) Performance: Stewardship Report	At the end of the 10-year FMP term the target is achieved or exceeded	Adjust strategies in subsequent AOPs
				Area of unsalvaged blowdown	In areas of significant blowdown greater than X% will be left unsalvaged	Targets are to be based on sound science, ecological considerations and disturbance regimes	Planning Standard	Salvage planning	Inventory updates	Stewardship Report	At the end of the 10-year FMP term the target is achieved or exceeded	Adjust strategies in subsequent AOPs

ANNEX 4 - Performance Standards

CCFM Criterion	CSA SFM Element	Value	Objective	Indicator	Target[1]	Means to Identify Target[2]	Legal / Policy Requirements	Means of achieving Objective and Target[3]	Monitoring and Measurement	Reporting	Acceptable Variance	Response
			1.1.1.6 Retain ecological values and functions associated with riparian zones	Compliance with OGR	Consistent with OGR	OGR	Federal Fisheries Act, Water Act	Planning, TSA, OGR	Organization reports, air photo interpretation, ground surveys, post harvest assessments or other existing compliance monitoring systems	Performance: Stewardship Report	No variance	Immediate remedial action and / or administrative penalty
		1.1.2 Local/stand scale biodiversity	1.1.2.1 Retain stand level structure	a) % area / volume / stems residual structure (both living and dead), within a harvest area, representative of the status (live / dead), sizes, and species of the overstorey trees by subunit and entire DFA	a) A combination of single stems, clumps, and islands comprising X% of the harvested area / volume / stems within a subunit Note: A wide range in variability in harvest area-level retention within a subunit is desired as long as the target level is achieved.	Wildlife zones, roadside vegetation reviews, recreational values, aesthetics, local knowledge, ANHIC, Biodiversity / Species Observation Database (BSOD)	Occupational Health and Safety Act, Forest and Prairie Protection Act	Implement residual structure retention strategies and OGRs	Organization reports, air photo interpretation, ground surveys, post harvest assessments	Performance: Stewardship Report	At the end of the 10-year FMP term the target is achieved or exceeded	Adjust strategies in subsequent FMP
				b) Percentage of harvested area by subunit with downed woody debris[4] equivalent to preharvest conditions	b) X% of harvest areas having downed woody debris retained on site	Assess preharvest downed woody debris condition by subunit or stand level average	Planning Standard	Organization developed standards	Organization developed during FMP planning	Performance: Report % of harvest areas with retained downed woody debris	FMP determined	Adjust strategies in subsequent FMPs
			1.1.2.2 Maintain integrity of sensitive sites	Sensitive sites (e.g. mineral licks, major game trails) by subunit and entire DFA	Strategies to maintain consistent with provincial guidelines / OGR	Local knowledge, ANHIC, Biodiversity / Species Observation Database (BSOD)	Planning Standard	Organization developed standards for sensitive site protection, OGRs 7.7.4	Organization reports, air photo interpretation, ground surveys	Performance: Stewardship Report	None	Adjust strategies in subsequent AOPs
			1.1.2.3 Maintain aquatic biodiversity by minimizing impacts of water crossings	Forestry water crossings in compliance with Code of Practice for Water Course Crossings within each subunit	Designs meet standards of the Code of Practice for Water Course Crossings	Code of Practice for Water Course Crossings: Sections 7 - 9 and Schedule 2	Code of Practice for Water Course Crossings	Road construction, maintenance and reclamation activities	Road plan OGR 11.2	Performance: Stewardship Report: AOP, number of crossings by type within each subunit by compliance status	None	Act immediately to eliminate problems and adjust strategies in subsequent AOPs

ANNEX 4 - Performance Standards

CCFM Criterion	CSA SFM Element	Value	Objective	Indicator	Target[1]	Means to Identify Target[2]	Legal / Policy Requirements	Means of achieving Objective and Target[3]	Monitoring and Measurement	Reporting	Acceptable Variance	Response
	1.2 Species Diversity Conserve species diversity by ensuring that habitats for the native species found in the DFA are maintained throughout time	1.2.1 Viable populations of identified plant and animal species	1.2.1.1 Maintain habitat for identified high value species (i.e., economically valuable, socially valuable, species at risk, species of management concern)	Area (ha) of suitable habitat within the DFA or subunit OR Specific population parameter(s) (e.g. trends, distribution, absolute size, recruitment) for the DFA or subunit	Maintain above X hectares OR Maintained or increased	Based on sound science, ecological considerations, wildlife issues, Committee on the Status of Endangered Wildlife in Canada (COSEWIC) list, provincially listed species, BSOD, ANHIC, Recovery plans, Fish and Wildlife Division priorities, public consultation, habitat suitability analysis, literature review, observation data, local and traditional knowledge	Recovery plans for species at risk, Federal Species at Risk Act	Harvesting plans, road construction, OGR, planning and implementation, adherence to provincial wildlife guidelines	Habitat assessment mapping, population monitoring	FMP: For species with a suitable habitat target provide tables of area (ha) of suitable habitat at 0, 10, 50, 100, and 200 years. Maps of suitable habitat at 0, 10, and 50 years OR For species with population parameter targets provide table with current parameter Performance Stewardship Report	At the end of the 10-year FMP term the target is achieved or exceeded	Adjust strategies in subsequent FMP
	1.3 Genetic Diversity Conserve genetic diversity by maintaining the variation of genes within species	1.3.1 Genetic integrity of natural tree populations	1.3.1.1 Retain "wild forest populations" for each tree species in each seed zone through establishment of in-situ reserves by the organization or in cooperation with Alberta	Number and area (ha) of in situ genetic conservation areas	Number (X) of genetic conservation areas for each seed zone conforming with Section 3 of the Green Area section of Standards for Tree Improvement in Alberta	Target is a portion of the required number of genetic conservation areas determined in consultation with other FMAs in the same seed zone and Alberta	Standards regulated through Timber Management Regulation 144.2	Conservation areas are designated by a notation (PNT, CNT)	AVI updates, ground or air checks to confirm status. FMP planning and Stewardship Reporting	FMP: Table showing number of genetic conservation areas required in each seed zone and number provided in DFA. Map showing locations of genetic conservation areas Performance Stewardship Report	At the end of the 10-year FMP term the target is achieved or exceeded	Adjust strategies in subsequent FMP
			1.3.1.2 Retain wild forest genetic resources through ex-situ conservation	Number of provenance and genetic lines in ex-situ gene banks and trials	Active conservation program for all Controlled Parentage Program plan species and other species in cooperation with Alberta	Proportion of projects and species	Standards regulated through Timber Management Regulation 144.2	Standards for Tree Improvement in Alberta and government / industry genetic cooperatives	Conservation activities identified in FMP as per Standards for Tree Improvement in Alberta	FMP: Table showing number of genetic conservation areas required in each seed zone and number provided in DFA. Map showing locations of genetic conservation areas	Confirmed program plan	Organization / Alberta / cooperatives

ANNEX 4 - Performance Standards

CCFM Criterion	CSA SFM Element	Value	Objective	Indicator	Target[1]	Means to Identify Target[2]	Legal / Policy Requirements	Means of achieving Objective and Target[3]	Monitoring and Measurement	Reporting	Acceptable Variance	Response
	1.4 Protected Areas - Respect protected areas identified through government processes	1.4.1 Areas with minimal human disturbances within managed landscapes	1.4.1.1 Integrate transboundary values and objectives into forest management	Stakeholder consultation	Ongoing consultation with relevant protected areas agencies	Link to consultation objective in Planning Standard or other existing consultation processes	Planning Standard	Management planning	Documentation of consultation processes	Performance: Stewardship Report	None	Adjust strategies in subsequent FMP
2.) Ecosystem Productivity	2.1 Ecosystem resilience	2.1.1 Reforested harvest areas	2.1.1.1 Meet reforestation targets on all harvested areas	Annual % of SR regeneration surveys	Set target based on timber supply analysis	ARIS or equivalent reports	Timber Management Regulation	Silviculture program	Regeneration surveys	ARIS, AOP, Stewardship Report	None	Alberta adjusts AAC
				Cumulative % of reforested areas that meet reforestation target	As above	ARIS or equivalent reports and Stewardship Report	Planning Standard	Silviculture program	Regeneration surveys	AOP and Stewardship Report	None	Alberta adjusts AAC
		2.1.2 Maintenance of forest landbase	2.1.2.1 Limit conversion of productive forest landbase to other uses	Amount of change in forest landbase	A program to maintain the forest landbase	Forest inventory and land use data	Planning Standard	Maintain current forest cover inventory and land use updates	Inventory and land use systems	Stewardship Report	Report actual	Adjust net landbase projections in next TSA
			2.1.2.2 Recognize lands effected by insects, disease or natural calamities	Amount of area affected	Area (ha) affected by significant outbreaks, infestations, natural calamities	Forest health surveys, inventory updates	Planning Standard, Alberta Forest Health Strategy and Shared Roles and Responsibilities between SRD and the Forest Industry	Maintain up-to-date information	Annual surveys	AOP and Stewardship Report	Report actuals	Event specific
		2.1.3 Control invasive species	2.1.3.1 Control non-native plant species (weeds)	Noxious weed program	Noxious weed program in place and implemented	Field inventories	Directive 2000-06	Co-operative programs	Field inventories	Inspections summarized in Stewardship Report	Report actuals	Improve weed program
3. Soil and water	3.1 Soil quantity and quality	3.1.1 Soil productivity	3.1.1.1 Minimize impact of roading and bared areas in forest operations	Compliance with OGRs	Less than 5%	Direction from Alberta	OGRs and Soils Guidelines	Effective planning and supervision of operations	Field inspection reports and audits	Inspection reporting	None	Immediate remedial action to correct
			3.1.1.2 Minimize incidence of soil erosion and slumping	Incidence of soil erosion and slumping	Complete compliance	Direction from Alberta	OGRs and Soils Guidelines	Effective planning and supervision of operations and adherance to relevent OGRs	Field inspection reports and audits	Inspection reporting	None	Immediate remedial action to correct
	3.2 Water quantity and quality	3.2.1 Water quantity	3.2.1.1 Limit impact of timber harvesting on water yield	Forecast impact of timber harvesting on water yield	Zero Water Act penalties, Complete compliance with FMP	Water Strategy and local needs	Water Act, Planning Standard	Adherance to forecast harvest sequence and relevent OGRs	Report on area (ha) harvested compared with planned harvest area	Stewardship Report	Report actuals	Adjust harvest pattern if problems arise
		3.2.2 Effective riparian habitats	3.2.2.1 Minimize impact of operations in riparian areas	Riparian buffers maintained as outlined in OGRs	Complete compliance	Direction from Alberta	OGRs	Effective planning and supervision of operations	AOPs, Stewardship Reports	AOP	None	Immediate correction and / or administrative penalty

ANNEX 4 - Performance Standards

CCFM Criterion	CSA SFM Element	Value	Objective	Indicator	Target[1]	Means to Identify Target[2]	Legal / Policy Requirements	Means of achieving Objective and Target[3]	Monitoring and Measurement	Reporting	Acceptable Variance	Response
4. Global Ecological Cycles	4.1 Carbon uptake and storage	To be determined	To be determined	Results of carbon budget modeling	To be determined							
	4.2 Forest land conversion	See 2.1.2 above										
5. Multiple Benefits to Society	5.1 Timber and non-timber benefits	5.1.1 Sustainable timber supplies	5.1.1.1 Establish appropriate AACs	Process described in Annex 1 is followed and standards are met	Complete compliance	Consultation in planning process	Forests Act and Timber Management Regulation	Effective implementation of planning process	Multiple means: TPRS, ARIS, AOPs, Stewardship Reports, filed inspection reports	Progressive and continuous	Issue specific	Adjust AAC using most current and relevant information

ANNEX 4 - Performance Standards

CCFM Criterion	CSA SFM Element	Value	Objective	Indicator	Target[1]	Means to Identify Target[2]	Legal / Policy Requirements	Means of achieving Objective and Target[2]	Monitoring and Measurement	Reporting	Acceptable Variance	Response
	5.2 Communities and Sustainability	5.2.1 Risk to communities and landscape values from wildfire is low	5.2.1.1 To reduce wildfire threat potential by reducing fire behaviour, fire occurrence, threats to values at risk and enhancing fire suppression capability	1) Percentage reduction in Fire Behaviour Potential area (ha) within the FireSmart Community Zone 2) Percentage reduction in Fire Behaviour Potential area (ha) across the DFA now and over the planning horizon	1) Reduce the area (ha) in the extreme and high Fire Behaviour Potential rating categories by X% within the FireSmart Community Zone 2) Reduce the area (ha) in the extreme and high Fire Behaviour Potential rating categories by X% across the DFA	Planning process, wildfire threat assessment	Planning Standard.	Spatial harvest sequence, thinning, partial harvest techniques, prescribed burns	AOPs, Compartment Assessments	FMP: Maps and Tables of indicator at 0, 10, 20, and 50 yrs Performance: Stewardship Report	Issue specific	Adjust harvest sequence
		5.2.2 Provide opportunities to derive benefits and participate in use and management	5.2.2.1 Integrate other uses and timber management activities	Extent of various uses	To be determined in the planning process	Consultation and co-operation	Legislation and policy	Effective implementation of plans	AOPs, Compartment Assessments	Stewardship Report	Issue specific	Adjust activities
		5.2.3 Forest Productivity	5.2.3.1 Maintain Long Run Sustained Yield Average	Regenerated stand yield compared to natural stand yield	No net decrease from the natural stand productivity	FMP Timber Supply Analysis	Planning Standard	Effective implementation of plans	Stewardship Report	Timber Supply Analysis, Stewardship Report	Report actual	Adjust AAC using most current and relevant information
6. Accepting society's responsibility for sustainable development	6.1 Aboriginal and treaty rights and aboriginal forest values	6.1.1 Compliance with government regulations and policies	6.1.1.1 Implement Public Involvement Program	Meet Alberta's current expectations for aboriginal consultation	Consult at the community level with designated representatives of affected aboriginal communities	Alberta to provide direction	Planning Standard	Effective implementation of Public Involvement Program		Reports as required in Public Involvement Plan	To be determined	Adjust activities
	6.2 Public participation and information for decision-making	6.2.1 Meaningful public involvement is achieved	6.2.1.1 Implement public involvement program	Meet expectations of Section 5 of CSA Z809-02	To be determined in the planning process	Consultation	Planning Standard	Effective implementation of public involvement program		Reports as required in Public Involvement Plan	To be determined	Adjust activities

Footnotes:

[1] "X" variable in target description to be determined by the FMP planning process.

[2] Items noted under the "Means to identify Targets" and "Means of Achieving Objectives and Targets" are intended as suggestions and not meant to limit potential approaches. The list is not comprehensive or mandatory.

[3] Seral Stage: Seral stages definitions should include the following categories: Initiation, Establishment, Aggradation (stem exclusion), Mature, and Old (Song 2002, Ecological Basis for Stand Management in Alberta). Old forest is defined as stands 40 years older than MAI culmination age.

[4] Subseral: any acceptable stratification of the DFA. Delineation of planning "subseals" for the DFA will be made during FMP planning. However, delineation should reflect ecological considerations. Planning subseals may correspond to planning compartments.

[5] Cover-classes: definitions will be developed through FMP planning. In general, cover-class is a coarser grouping than the cover type (AVI stand label) but provides finer resolution than the cover groups (C, CD, DC, D) and will reflect leading species and stand/wood types.

[6] Patch: a stand of forest in the same seral stage, and not split by a linear feature greater than 8m wide. Linear features in this definition include roads, pipelines, powerlines, and rivers, but does not include seismic lines.

[7] Interior forest: a forested area greater than 100 hectares in size located beyond edge effect buffer zone (7.2) along the forest edge (7.1). For interior forest objective use a consistent age definitions for all cover classes to prevent breaking up forest patches that have a consistent origin date.

(7.1) Forest edge: any of the following: a) a linear disruption in forest cover greater than 8m in width, or, b) the line along which forest seral stage class changes.

(7.2) Edge effect buffer zone: 60 m where adjacent area is non-forested or less than 40 years old; 30 m where adjacent forest stand is >= 40 years and less than mature forest; 0 m where adjacent stand is mature forest.

[8] Downed woody debris: wood lying at an angle of less than 45 degrees from the ground and having a diameter greater than 7.5 cm.

[9] Wild: genetic materials of native species originating from natural regeneration (Standards for Forest Tree Improvement in Alberta)

Interpretive Bulletin
Forest Management Planning Roles, Responsibilities and Approval Authorities

Introduction

This standard is based on a planning process of progressive development and review of plan components followed by agreement among the Plan Development Team (PDT) members that the planning standard has been met for that item. Efficient plan development requires that concurrent planning, review, and analysis activities occur. The PDT must work to reduce delays and reach timely agreements.

The following FMP Process and Content Standards of the Alberta Forest Management Planning Standard are relevant:

i. Section 2 - standard 1.5: Roles Responsibilities and Obligations of Participants;
ii. Section 2 - standard 1.7: Decision-making Methods; and
iii. Section 2 - standard 1.8: Authority for Decisions.

A. The Plan Development Team must be formed to resolve the technical details of a *forest management plan*. The PDT is to reach *agreement-in-principle* on all components of the plan prior to is completion. The composition of the PDT Core Membership is as follows unless Alberta agrees otherwise in the ToR:

PDT Core Members
FMA planners and staff
Alberta Forest Planning Section planner
Alberta Forest Area Planning Forester
Alberta Senior Operations Forester
Alberta Fish and Wildlife Division staff
Alberta Timber Supply Analysts
Alberta Growth and Yield Analysts
Quota Operators

Advisors
Alberta Forest Protection Division planner
Alberta Public Lands Division staff (as required)
Alberta Community Development staff (as required)
Alberta Resource Data Division staff (as required)
Community Timber Program (Local Advisory Committee Chair)
Experts (invited to participate as required)
Canada Department of Fisheries and Oceans staff (as required)

B. In the event the PDT cannot reach *agreement-in-principle*, the FMP development process may be brought to an end when, in the opinion of the Senior Manager, Forest Planning Section, further discussions will be of limited value in moving the FMP to completion. When this authority is exercised, the Organization shall be directed to submit the plan components and supporting data to Alberta. Depending on the state of plan completion and the data provided, one of the following actions may result:

i. An Approval Decision shall be issued, or
ii. A *precautionary AAC* shall be established by Alberta that shall be followed by operators on the FMA until such time that an acceptable FMP is approved.

C. FMPs submitted for appraisal shall be reviewed by an Approval Review Committee chaired by the Senior Manager, Forest Planning Section, and shall provide recommendations to the Executive Director, FMB for his consideration and final decision on a FMP.

D. FMPs are approved by the Executive Director of Forest Management Branch. Final approval of all components occurs when the FMP is approved though the issuance of an approval decision.

Authority for Decisions

Accountability[1]

The Senior Manager, Forest Planning Section oversees the development of FMPs and is the primary contact for industry concerning forest management planning information, *issues* and concerns. This section chairs the Approval Review Committee that prepares recommendations concerning the approval of FMPs to the Executive Director.

The Planning Forester, Forest Planning Section is Alberta's lead representative on the PDT.

The Senior Manager, Resource Analysis Section reviews technical aspects of the timber supply analysis and growth and yield monitoring of the FMP.

The Senior Manager, Harvest and Renewal Section reviews *Timber Harvest Planning and Operating Ground Rules*, silvicultural and operational aspects of the FMP.

The Senior Manager, Forest Health Section reviews *forest health* strategies, control programs and trans-boundary effects of each.

The *Area Manager* provides staff, *resources* and facilities to assist Alberta in meeting its obligations for plan development and review. The *Area Manager* ensures the operational implementation (FHP/AOP/GDP) is consistent with the approved FMP.

Review Types and Timelines[2]

All plan components , except for those listed in Table 1 must be approved-in-principle by the reviewers before being incorporated into a FMP. To ensure timely FMP development reviewers will respond to the Organization within 30 days of receiving the submission. At the completion of a FMP, the PDT requires 60 days to review the complete document.

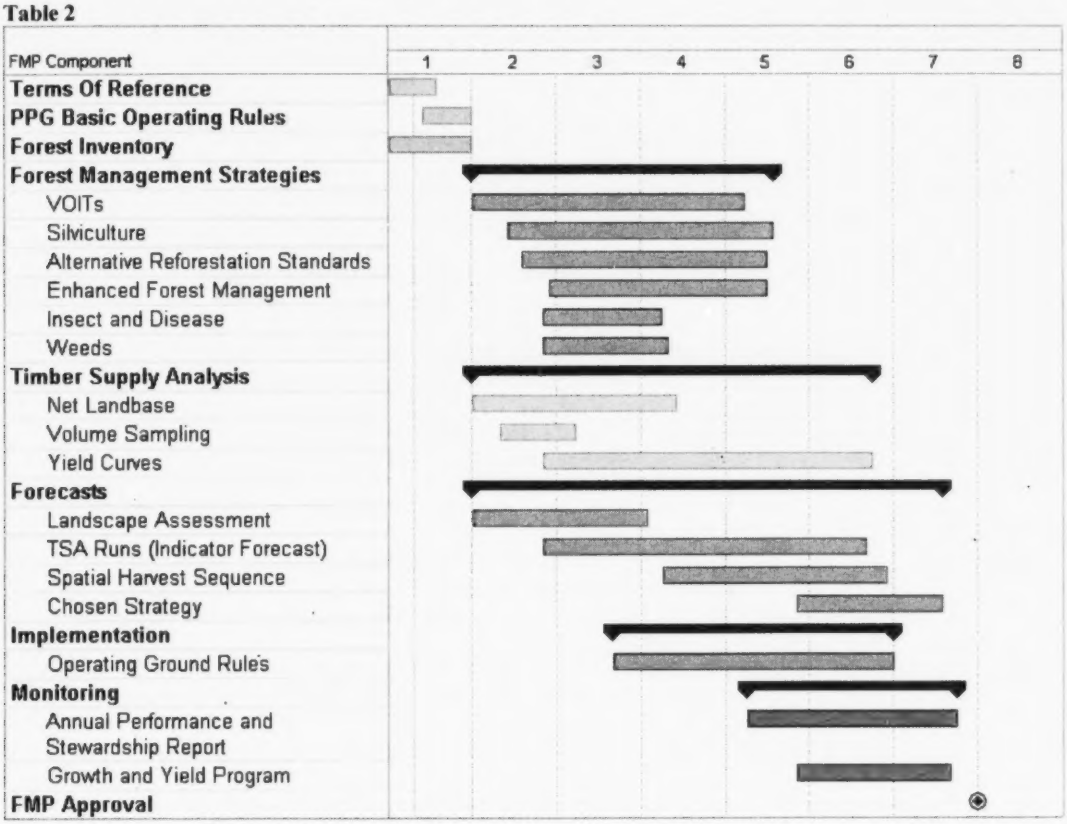
Table 1

Plan Component	Approval Type	Accountability	Review Timelines[2]
• FMP Terms of Reference • PPG Basic Operating Rules	Approval	Forest Planning Section	30 days per component
• Partial Harvest Plans	Approval	Forest Management Specialist	30 days
• Final Harvest Plans • Annual Operating Plans • General Development Plans • Compartment Assessments	Approval	Area Manager	5 days for FHP 30 days for AOP/GDP/CA
• **Forest Management Plans**	**Approval Decision**	**Executive Director**	**100 days** from submission date

[1] Accountability rests with the Senior Manager of the section unless otherwise specified.
[2] Review timelines are presented in Alberta government business days.

FMP components should be developed concurrently enabling Organization's to use time, staff, consultants and *resources* economically (see example in Table 2). The following table presents a simplified summary of FMP components and concurrent scheduling.

Table 2



Interpretive Bulletin
Yield Projection Guidelines for Alberta

A.) Introduction

The Alberta Forest Management Planning Standard together with this *Interpretive Bulletin* define Alberta's expectations regarding *yield projections* and related regeneration standards on Alberta Crown lands in the Green Area.

The following sections of the Planning Standard are relevant:

- Annex 1, standards 4.1, 4.2, and 4.3 require that methods used for developing yield projections (including data collection programs) and regeneration standards assumed in company forest management plans (FMP) must be approved by Alberta.
- Annex 1, standards 3.10 and 4.2.11 require that each harvested area be assigned to a yield stratum.
- Annex 1, Appendix A, standard 2.3.2 describes adjusting AACs using reforestation results.
- Annex 1, standard 4.3 Reforestation Performance Standards – organizations are required to develop *alternative regeneration standards*.

Alberta recognizes the following key concepts:

- Obtaining the data required to develop valid and *accurate yield projections* is a costly, long-term process. The efficiency of developing and monitoring yield projections could be substantially improved through co-operative work.
- Growth and yield programs must be designed so that monitoring is practical and feasible (see CSA Z809-02 standard 7.3.6.4 of for related discussion).
- Monitoring protocols and regeneration standards require Alberta's approval.
- Alberta believes the highest priority is to develop valid and *accurate yield projections* and regeneration standards for managed stands.

B.) General Outline

Alberta conceptualizes the growth of stands as being comprised of two phases:

i. Reforestation Phase – from stand initiation to the last legislated reforestation survey. The results of such surveys will be used to assign each harvest area to the appropriate yield strata. This phase is divided into an establishment period and a performance period.
ii. Growth Phase – the period in a stand's development from the time of the last legislated survey to harvest.

Alternative Regeneration Standards

Regeneration standards will be derived from the relationships between stand condition observed at the last legislated reforestation survey, and stand condition at the proposed harvest age. The mechanism to develop these relationships will rely heavily on empirical modelling systems acceptable to Alberta.

C.) Stratification

Alberta believes it prudent to adopt a standardized stratification for *yield projections* and associated regeneration standards. Table 1 describes the stratification deemed acceptable by Alberta. This stratification is reasonable and meets the following criteria in Alberta's opinion:

- consistent with the majority of strata currently in use
- stands can be assigned to one stratum only
- applicable across the Province
- covers all natural and managed forest types Alberta
- can be collapsed on different scales
- facilitates consistent reporting and comparisons
- allows flexibility

Each stratum would be divided into low, medium and high projections to allow the assignment of yield projections that vary due to density, treatment, or site. Stratification of managed stands would not be based on the treatment, but rather on the target yield (low, medium, or high) justified by the management techniques employed.
Strata may be further segregated by ecoregion if statistically essential and logistically feasible.

E. Sampling Design and Administration for Monitoring

Alberta's objective is to implement a sampling design that reduces total costs and generates higher value products. To this end, a co-ordinated systematic grid of monitoring plots is proposed for the entire Province, to be augmented with additional plots for localization and/or where the systematic grid proves to be inadequate for a particular natural or managed stratum.

	Minimum Stratification				Recommended Stratification			
Broad Cover Type	Stratum #	Stratum Name	Leading Species	Other Species	Stratum #	Stratum Name	Leading Species	Other Species
D	I	Deciduous	Aw, Pb, Bw or A pure or leading	Any	1	Pure Aspen	Aw, or A pure (par1>=9)	Any
					2	Aspen leading	Aw, Bw or A leading	Any
					3	Poplar leading	Pb leading	Any
DC	II	Hardwood/Pine	Aw, Bw or A leading D component	With P, Pl, Pj, Pa or Pf leading C component	4	Aspen/Pine	Aw, Bw or A leading D component	P, Pl, Pj, Pa or Pf leading C component
					5	Poplar/Pine	Pb leading D component	P, Pl, Pj, Pa or Pf leading C component
	III	Hardwood/Spruce	Aw, Bw or A leading D component	Without P, Pl, Pj, Pa or Pf leading C component	6	Aspen/White Spruce	Aw, Bw or A leading D component	Sw or Se leading C component
					7	Poplar/White Spruce	Pb leading D component	Sw or Se leading C component
					8	Aspen/Black Spruce	Aw, Bw or A leading D component	Sb, Lt, La or Lw leading C component
					9	Poplar/Black Spruce	Pb leading D component	Sb, Lt, La or Lw leading C component
					10	Aspen/Fir	Aw, Bw or A leading D component	Pb, Fa or Fd leading C component
					11	Poplar/Fir	Pb leading D component	Pb, Fa or Fd leading C component
CD	IV	White Spruce/Hardwood	Sw, Se, Pb, Fa or Fd leading C component	Aw, Pb, Bw or A leading D component	12	White Spruce/Aspen	Sw or Se leading C component	Aw, Bw or A leading D component
					13	White Spruce/Poplar	Sw or Se leading C component	Pb leading D component
					14	Fir/Aspen	Pb, Fa or Fd leading C component	Aw, Bw or A leading D component
					15	Fir/Poplar	Pb, Fa or Fd leading C component	Pb leading D component
	V	Pine/Hardwood	P, Pl, Pj, Pa or Pf leading C component	Aw, Pb, Bw or A leading D component	16	Pine/Aspen	P, Pl, Pj, Pa or Pf leading C component	Aw, Bw or A leading D component
					17	Pine/Poplar	P, Pl, Pj, Pa or Pf leading C component	Pb leading D component
	VI	Black Spruce/Hardwood	Sb, Lt, La or Lw leading C component	Aw, Pb, Bw or A leading D component	18	Black Spruce/Aspen	Sb, Lt, La or Lw leading C component	Aw, Bw or A leading D component
					19	Black Spruce/Poplar	Sb, Lt, La or Lw leading C component	Pb leading D component
C	VII	White Spruce pure or leading	Sw, Se, Fb or Fa pure or leading	Any	20	Pure White Spruce	Sw or Se pure (par1>=9)	Any
					21	White Spruce leading	Sw or Se leading	Any
					22	Balsam Fir pure or leading	Fb or Fa pure or leading	Any
	VIII	Pine pure or leading	P, Pl, Pj, Pa or Pf pure or leading	Any	23	Pure Pine	P, Pl, Pj, Pa or Pf pure (par1>=9)	Any
					24	Pine leading	P, Pl, Pj, Pa or Pf leading	Any
	IX	Black Spruce pure or leading	Sb, Lt, La or Lw pure or leading	Any	25	Black Spruce pure or leading	Sb, Lt, La or Lw pure or leading	Any
	X	Douglas Fir pure or leading	Fd pure or leading	Any	26	Douglas Fir pure or leading	Fd pure or leading	Any

Extended Stratification (used to address specific local issues)

Stratum #	Stratum Name	Broad Cover Type	Leading Species	Other Species
D1	Pure Aspen	D	Aw or A pure (per1>=9)	Any
D2	Aspen leading with Poplar		Aw or A leading	With Pb
D3	Aspen leading without Poplar		Aw or A leading	Without Pb
D4	Poplar leading		Pb leading	Any
D5	Birch leading		Bw leading	Any
DC1	Aspen/White Spruce	DC	Aw or A leading D component	Sw or Se leading C component
DC2	Aspen/Pine			P, Pl, Pj, Pa or Pf leading C component
DC3	Aspen/Black Spruce			Sb, Lt, La or Lw leading C component
DC4	Aspen/Fir			Fb, Fa or Fd leading C component
DC5	Poplar/White Spruce		Pb leading D component	Sw or Se leading C component
DC6	Poplar/Pine			P, Pl, Pj, Pa or Pf leading C component
DC7	Poplar/Black Spruce			Sb, Lt, La or Lw leading C component
DC8	Poplar/Fir			Fb, Fa or Fd leading C component
DC9	Birch/White Spruce		Bw leading D component	Sw or Se leading C component
DC10	Birch/Pine			P, Pl, Pj, Pa or Pf leading C component
DC11	Birch/Black Spruce			Sb, Lt, La or Lw leading C component
DC12	Birch/Fir			Fb, Fa or Fd leading C component
CD1	White Spruce/Aspen	CD	Sw or Se leading C component	Aw or A leading D component
CD2	White Spruce/Poplar			Pb leading D component
CD3	White Spruce/Birch			Bw leading D component
CD4	Pine/Aspen		P, Pl, Pj, Pa or Pf leading C component	Aw or A leading D component
CD5	Pine/Poplar			Pb leading D component
CD6	Pine/Birch			Bw leading D component
CD7	Black Spruce/Aspen		Sb, Lt, La or Lw leading C component	Aw or A leading D component
CD8	Black Spruce/Poplar			Pb leading D component
CD9	Black Spruce/Birch			Bw leading D component
CD10	Fir/Aspen		Fb, Fa or Fd leading C component	Aw or A leading D component
CD11	Fir/Poplar			Pb leading D component
CD12	Fir/Birch			Bw leading D component
C1	Pure White Spruce	C	Sw or Se pure (per1>=9)	Any
C2	White Spruce leading with Pine		Sw or Se leading	With P, Pl, Pj, Pa or Pf
C3	White Spruce leading without Pine			Without P, Pl, Pj, Pa or Pf
C4	Pure Pine		P, Pl, Pj, Pa or Pf pure (per1>=9)	Any
C5	Pine leading with White Spruce		P, Pl, Pj, Pa or Pf leading	With Sw or Se
C6	Pine leading with Black Spruce			With Sb
C7	Pine leading with Fir			With Fb or Fa
C8	Pine leading without Spruce and Fir			Without Sb, Sw, Se, Fb and Fa
C9	Pure Black Spruce		Sb pure (per1>=9)	Any
C10	Black Spruce leading with Pine		Sb leading	With P, Pl, Pj, Pa or Pf
C11	Black spruce leading without Pine			Without P, Pl, Pj, Pa or Pf
C12	Larch leading		Lt, La or Lw leading	Any
C13	Pure Douglas Fir		Fd pure (per1>=9)	Any
C14	Douglas Fir leading		Fd leading	Any
C15	Pure Balsam Fir		Fb or Fa pure (per1>=9)	Any
C16	Balsam Fir leading with Pine		Fb or Fa leading	With P, Pl, Pj, Pa or Pf
C17	Balsam Fir leading without Pine			Without P, Pl, Pj, Pa or Pf

Stratification Decision Rules

Strata #	Name	Broad Cover Type	Leading Species	Other Species	Decision Rules	Example Species Compositions
D1	Pure Aspen	D	Aw pure	Any	if (Aw+Pb+Bw>=8) & (Aw>=9)	Aw10, A10, Aw9Pb, Aw9Bw1
D2	Aspen leading with Poplar		Aw leading	With Pb	if (Aw+Pb+Bw>=8) & (Aw>Pb and Aw>Bw) & (Pb>1)	Aw7Pb2Sw1, Aw4Pb4Bw2
D3	Aspen leading without Poplar		Aw leading	Without Pb	if (Aw+Pb+Bw>=8) & (Aw>Pb and Aw>Bw) & (Aw<9 and Pb<=1)	Aw8Sw2, Aw7Bw3
D4	Poplar leading		Pb leading	Any	if (Aw+Pb+Bw>=8) & (Pb>Aw and Pb>Bw)	Pb7Aw2Bw1, Pb10, Pb9Sb1
D5	Birch leading		Bw leading	Any	if (Aw+Pb+Bw>=8) & (Bw>Pb and Bw>Aw)	Bw10, Bw3Aw4Sw1
DC1	Aspen/White Spruce	DC	Aw leading D component	Sw or Se leading C component	if (5<=Aw+Pb+Bw<8) & (Aw>Pb and Aw>Bw) & (Sw+Se>Fb+Fa+Fd and Sw+Se>P+Pl+Pj+Pa+Pf and Sw+Se>Sb+Lt+La+Lw)	Aw5Sw5, Aw5Sw3Pj2
DC2	Aspen/Pine			Pine leading C component	if (5<=Aw+Pb+Bw<8) & (Aw>Pb and Aw>Bw) & (P+Pl+Pj+Pa+Pf>Fb+Fa+Fd and P+Pl+Pj+Pa+Pf>Sw+Se and P+Pl+Pj+Pa+Pf>Sb+Lt+La+Lw)	Aw6Pl3Pb1, Aw7Pl3
DC3	Aspen/Black Spruce			Sb, Lt, La or Lw leading C component	if (5<=Aw+Pb+Bw<8) & (Aw>Pb and Aw>Bw) & (Sb+Lt+La+Lw>Fb+Fa+Fd and Sb+Lt+La+Lw>P+Pl+Pj+Pa+Pf and Sb+Lt+La+Lw>Sw+Se)	Aw4Sb3Pb3, Aw7Lt3
DC4	Aspen/Fir			Fb, Fa or Fd leading C component	if (5<=Aw+Pb+Bw<8) & (Aw>Pb and Aw>Bw) & (Fb+Fa+Fd>Sw+Se and Fb+Fa+Fd>P+Pl+Pj+Pa+Pf and Fb+Fa+Fd>Sb+Lt+La+Lw)	Aw7Fb3, Aw5Fb3Sw2
DC5	Poplar/White Spruce		Pb leading D component	Sw or Se leading C component	if (5<=Aw+Pb+Bw<8) & (Pb>Aw and Pb>Bw) & (Sw+Se>Fb+Fa+Fd and Sw+Se>P+Pl+Pj+Pa+Pf and Sw+Se>Sb+Lt+La+Lw)	Pb7Sw2Fb1, Pb7Bw3
DC6	Poplar/Pine			Pine leading C component	if (5<=Aw+Pb+Bw<8) & (Pb>Aw and Pb>Bw) & (P+Pl+Pj+Pa+Pf>Fb+Fa+Fd and P+Pl+Pj+Pa+Pf>Sw+Se and P+Pl+Pj+Pa+Pf>Sb+Lt+La+Lw)	Pb6Pj4
DC7	Poplar/Black Spruce			Sb, Lt, La or Lw leading C component	if (5<=Aw+Pb+Bw<8) & (Pb>Aw and Pb>Bw) & (Sb+Lt+La+Lw>Fb+Fa+Fd and Sb+Lt+La+Lw>P+Pl+Pj+Pa+Pf and Sb+Lt+La+Lw>Sw+Se)	Pb5Sb5, Pb7Sb2Lt1
DC8	Poplar/Fir			Fb, Fa or Fd leading C component	if (5<=Aw+Pb+Bw<8) & (Pb>Aw and Pb>Bw) & (Fb+Fa+Fd>Sw+Se and Fb+Fa+Fd>P+Pl+Pj+Pa+Pf and Fb+Fa+Fd>Sb+Lt+La+Lw)	Pb7Fb2Sw1
DC9	Birch/White Spruce		Bw leading D component	Sw or Se leading C component	if (5<=Aw+Pb+Bw<8) & (Bw>Pb and Bw>Aw) & (Sw+Se>Fb+Fa+Fd and Sw+Se>P+Pl+Pj+Pa+Pf and Sw+Se>Sb+Lt+La+Lw)	Bw7Sw2Fb1, Bw7Bw3
DC10	Birch/Pine			Pine leading C component	if (5<=Aw+Pb+Bw<8) & (Bw>Pb and Bw>Aw) & (P+Pl+Pj+Pa+Pf>Fb+Fa+Fd and P+Pl+Pj+Pa+Pf>Sw+Se and P+Pl+Pj+Pa+Pf>Sb+Lt+La+Lw)	Bw6Pj4
DC11	Birch/Black Spruce			Sb, Lt, La or Lw leading C component	if (5<=Aw+Pb+Bw<8) & (Bw>Pb and Bw>Aw) & (Sb+Lt+La+Lw>Fb+Fa+Fd and Sb+Lt+La+Lw>P+Pl+Pj+Pa+Pf and Sb+Lt+La+Lw>Sw+Se)	Sb4Bw3Aw3, Bw7Lt3
DC12	Birch/Fir			Fb, Fa or Fd leading C component	if (5<=Aw+Pb+Bw<8) & (Bw>Pb and Bw>Aw) & (Fb+Fa+Fd>Sw+Se and Fb+Fa+Fd>P+Pl+Pj+Pa+Pf and Fb+Fa+Fd>Sb+Lt+La+Lw)	Bw5Fa5
CD1	White Spruce/Aspen	CD	Sw or Se leading C component	Aw leading D component	if (2<Aw+Pb+Bw<=5) & (Sw+Se>Fb+Fa+Fd and Sw+Se>P+Pl+Pj+Pa+Pf and Sw+Se>Sb+Lt+La+Lw) & (Aw>Pb and Aw>Bw)	Sw5Aw5, Sw7Aw3
CD2	White Spruce/Poplar			Pb leading D component	if (2<Aw+Pb+Bw<=5) & (Sw+Se>Fb+Fa+Fd and Sw+Se>P+Pl+Pj+Pa+Pf and Sw+Se>Sb+Lt+La+Lw) & (Pb>Aw and Pb>Bw)	Sw7Pb2Aw1, Pb4Sw4Sb2
CD3	White Spruce/Birch			Bw leading D component	if (2<Aw+Pb+Bw<=5) & (Sw+Se>Fb+Fa+Fd and Sw+Se>P+Pl+Pj+Pa+Pf and Sw+Se>Sb+Lt+La+Lw) & (Bw>Pb and Bw>Aw)	Se7Bw3
CD4	Pine/Aspen		P, Pl, Pj, Pa or Pf leading C component	Aw leading D component	if (2<Aw+Pb+Bw<=5) & (P+Pl+Pj+Pa+Pf>Fb+Fa+Fd and P+Pl+Pj+Pa+Pf>Sw+Se and P+Pl+Pj+Pa+Pf>Sb+Lt+La+Lw) & (Aw>Pb and Aw>Bw)	Pl6Aw4
CD5	Pine/Poplar			Pb leading D component	if (2<Aw+Pb+Bw<=5) & (P+Pl+Pj+Pa+Pf>Fb+Fa+Fd and P+Pl+Pj+Pa+Pf>Sw+Se and P+Pl+Pj+Pa+Pf>Sb+Lt+La+Lw) & (Pb>Aw and Pb>Bw)	Pj5Pb3Sw2
CD6	Pine/Birch			Bw leading D component	if (2<Aw+Pb+Bw<=5) & (P+Pl+Pj+Pa+Pf>Fb+Fa+Fd and P+Pl+Pj+Pa+Pf>Sw+Se and P+Pl+Pj+Pa+Pf>Sb+Lt+La+Lw) & (Bw>Pb and Bw>Aw)	Pl7Bw3, Pj5Bw3Aw2
CD7	Black Spruce/Aspen		Sb, Lt, La or Lw leading C component	Aw leading D component	if (2<Aw+Pb+Bw<=5) & (Sb+Lt+La+Lw>Fb+Fa+Fd and Sb+Lt+La+Lw>P+Pl+Pj+Pa+Pf and Sb+Lt+La+Lw>Sw+Se) & (Aw>Pb and Aw>Bw)	Sb6Aw2Pb2, Sb7Aw3
CD8	Black Spruce/Poplar			Pb leading D component	if (2<Aw+Pb+Bw<=5) & (Sb+Lt+La+Lw>Fb+Fa+Fd and Sb+Lt+La+Lw>P+Pl+Pj+Pa+Pf and Sb+Lt+La+Lw>Sw+Se) & (Pb>Aw and Pb>Bw)	Lt7Pb3, Sb6Pb3Aw1
CD9	Black Spruce/Birch			Bw leading D component	if (2<Aw+Pb+Bw<=5) & (Sb+Lt+La+Lw>Fb+Fa+Fd and Sb+Lt+La+Lw>P+Pl+Pj+Pa+Pf and Sb+Lt+La+Lw>Sw+Se) & (Bw>Pb and Bw>Aw)	Sb6Bw2Aw1Lt1

CD10	Fir/Aspen		Fb, Fa or Fd leading C component	Aw leading D component	if (2<Aw+Pb+Bw<=5) & (Fb+Fa+Fd>Sw+Se and Fb+Fa+Fd>P+Pl+Pj+Pa+Pf and Fb+Fa+Fd>Sb+Lt+La+Lw) & (Aw>Pb and Aw>Bw)	Aw4Fb3Sw3, Fb7Aw3
CD11	Fir/Poplar			Pb leading D component	if (2<Aw+Pb+Bw<=5) & (Fb+Fa+Fd>Sw+Se and Fb+Fa+Fd>P+Pl+Pj+Pa+Pf and Fb+Fa+Fd>Sb+Lt+La+Lw) & (Pb>Aw and Pb>Bw)	Fb6Pb4, Fb6Pb3Sw1
CD12	Fir/Birch			Bw leading D component	if (2<Aw+Pb+Bw<=5) & (Fb+Fa+Fd>Sw+Se and Fb+Fa+Fd>P+Pl+Pj+Pa+Pf and Fb+Fa+Fd>Sb+Lt+La+Lw) & (Bw>Pb and Bw>Aw)	Fb6Bw2Aw2, Fb7Bw3
C1	Pure White Spruce	C	Sw or Se pure	Any	if (Aw+Pb+Bw<=2) & (Sw+Se>=9)	Se10, Sw10
C2	White Spruce leading with Pine		Sw or Se leading	With P, Pl, Pj, Pa or Pf	if (Aw+Pb+Bw<=2) & (Sw+Se<9) & (Sw+Se>Fb+Fa and Sw+Se>Fd and Sw+Se>P+Pl+Pj+Pa+Pf and Sw+Se>Sb and Sw+Se>Lt+La+Lw) & (P+Pl+Pj+Pa+Pf>1)	Sw8Pl2, Sw6Aw2Pj2
C3	White Spruce leading without Pine			Without P, Pl, Pj, Pa or Pf	if (Aw+Pb+Bw<=2) & (Sw+Se<9) & (Sw+Se>Fb+Fa and Sw+Se>Fd and Sw+Se>P+Pl+Pj+Pa+Pf and Sw+Se>Sb and Sw+Se>Lt+La+Lw) & (P+Pl+Pj+Pa+Pf<=1)	Sw8Aw2, Sw6Sb3Bw1
C4	Pure Pine		P, Pl, Pj, Pa or Pf pure	Any	if (Aw+Pb+Bw<=2) & (P+Pl+Pj+Pa+Pf>=9)	Pl10, Pj10
C5	Pine leading with White Spruce		P, Pl, Pj, Pa or Pf leading	With Sw or Se	if (Aw+Pb+Bw<=2) & (P+Pl+Pj+Pa+Pf<9) & (P+Pl+Pj+Pa+Pf>Sw+Se and P+Pl+Pj+Pa+Pf>Fb+Fa and P+Pl+Pj+Pa+Pf>Fd and P+Pl+Pj+Pa+Pf>Sb and P+Pl+Pj+Pa+Pf>Lt+La+Lw) & (Sw+Se>Fb+Fa and Sw+Se>Sb)	Pj4Sw4Aw2, Pj8Sw2
C6	Pine leading with Black Spruce			With Sb	if (Aw+Pb+Bw<=2) & (P+Pl+Pj+Pa+Pf<9) & (P+Pl+Pj+Pa+Pf>Sw+Se and P+Pl+Pj+Pa+Pf>Fb+Fa and P+Pl+Pj+Pa+Pf>Fd and P+Pl+Pj+Pa+Pf>Sb and P+Pl+Pj+Pa+Pf>Lt+La+Lw) & (Sb>Fb+Fa and Sb>Sw+Se)	Pl7Sb2Aw1
C7	Pine leading with Fir			With Fb or Fa	if (Aw+Pb+Bw<=2) & (P+Pl+Pj+Pa+Pf<9) & (P+Pl+Pj+Pa+Pf>Sw+Se and P+Pl+Pj+Pa+Pf>Fb+Fa and P+Pl+Pj+Pa+Pf>Fd and P+Pl+Pj+Pa+Pf>Sb and P+Pl+Pj+Pa+Pf>Lt+La+Lw) & (Fb+Fa>Sb and Fb+Fa>Sw+Se)	Pl6Aw2Fb2
C8	Pine leading without Spruce and Fir			Without Sb, Sw, Se, Fb and Fa	if (Aw+Pb+Bw<=2) & (P+Pl+Pj+Pa+Pf<9) & (P+Pl+Pj+Pa+Pf>Sw+Se and P+Pl+Pj+Pa+Pf>Fb+Fa and P+Pl+Pj+Pa+Pf>Fd and P+Pl+Pj+Pa+Pf>Sb and P+Pl+Pj+Pa+Pf>Lt+La+Lw) & (Fb+Fa<=1 and Sb<=1 and Sw+Se<=1)	Pl8Aw2, Pl7AwZLt1
C9	Pure Black Spruce		Sb pure	Any	if (Aw+Pb+Bw<=2) & (Sb>=9)	Sb10
C10	Black Spruce leading with Pine		Sb leading	With P, Pl, Pj, Pa or Pf	if (Aw+Pb+Bw<=2) & (Sb<9) & (Sb>Fb+Fa and Sb>Fd and Sb>P+Pl+Pj+Pa+Pf and Sb>Se+Sw and Sb>Lt+La+Lw) & (P+Pl+Pj+Pa+Pf>1)	Sb8Pl2, Sb6Pb2Pj2
C11	Black spruce leading without Pine			Without P, Pl, Pj, Pa or Pf	if (Aw+Pb+Bw<=2) & (Sb<9) & (Sb>Fb+Fa and Sb>Fd and Sb>P+Pl+Pj+Pa+Pf and Sb>Se+Sw and Sb>Lt+La+Lw) & (P+Pl+Pj+Pa+Pf<=1)	Sb8Fb2, Sb6Lt3Fb1
C12	Larch leading		Lt, La or Lw leading	Any	if (Aw+Pb+Bw<=2) & (Lt+La+Lw>Fb+Fa and Lt+La+Lw>Fd and Lt+La+Lw>P+Pl+Pj+Pa+Pf and Lt+La+Lw>Se+Sw and Lt+La+Lw>Sb)	Lt8Sb2, Lt6Fb2Sb2
C13	Pure Douglas Fir		Fd pure	Any	if (Aw+Pb+Bw<=2) & (Fd>=9)	Fd9Sw1, Fd10
C14	Douglas Fir leading		Fd leading	Any	if (Aw+Pb+Bw<=2) & (Fd<9) & (Fd>Lt+La+Lw and Fd>Fb+Fa and Fd>P+Pl+Pj+Pa+Pf and Fd>Se+Sw and Fd>Sb)	Fd7Sw3, Fd8Aw2
C15	Pure Balsam Fir		Fb or Fa pure	Any	if (Aw+Pb+Bw<=2) & (Fb+Fa>=9)	Fb10, Fa10
C16	Balsam Fir leading with Pine		Fb or Fa leading	With P, Pl, Pj, Pa or Pf	if (Aw+Pb+Bw<=2) & (Fb+Fa<9) & (Fb+Fa>Sw+Se and Fb+Fa>Fd and Fb+Fa>P+Pl+Pj+Pa+Pf and Fb+Fa>Sb and Fb+Fa>Lt+La+Lw) & (P+Pl+Pj+Pa+Pf>1)	Fb8Pl2, Fb6Aw2Pj2
C17	Balsam Fir leading without Pine			Without P, Pl, Pj, Pa or Pf	if (Aw+Pb+Bw<=2) & (Fb+Fa<9) & (Fb+Fa>Sw+Se and Fb+Fa>Fd and Fb+Fa>P+Pl+Pj+Pa+Pf and Fb+Fa>Sb and Fb+Fa>Lt+La+Lw) & (P+Pl+Pj+Pa+Pf<=1)	Fb8Bw2, Fb6Bw3Aw1

The generic deciduous cell ('A') is considered to be equal to 'Aw' for the purpose of this AVI stratification.

When the species composition is 50/50 between coniferous and deciduous and spl is coniferous then the Broad Cover Type is classified as CD.

When the species composition is 50/50 between coniferous and deciduous and spl is deciduous then the Broad Cover Type is classified as DC.

If two species have the same percentage the one that occurs higher in the species order is considered to have a higher percentage.